













Yorkshire Philosophical Society.

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ANNUAL REPORT

FOR

MDCCCXCII.





ANNUAL REPORT  
OF THE COUNCIL  
OF THE  
YORKSHIRE  
PHILOSOPHICAL SOCIETY

FOR

MDCCCXCII.

PRESENTED TO THE ANNUAL MEETING,

FEBRUARY 7TH, 1893.

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YORK:  
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1893.



TRUSTEES  
OF  
THE YORKSHIRE MUSEUM.

APPOINTED BY ROYAL GRANT.

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TEMPEST ANDERSON, M.D.

EDWIN GRAY, LL.M.

WILLIAM LAWTON.

T. S. NOBLE.

S. W. NORTH.

REV. CANON RAINE, D.C.L.

WILLIAM WALKER.

PATRONESSES

OF THE

**Yorkshire Philosophical Society.**

HER MAJESTY THE QUEEN.

H. R. H. THE PRINCESS OF WALES.

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PATRONS.

H. R. H. THE PRINCE OF WALES, K.G.

H. R. H. THE DUKE OF CONNAUGHT, K.G.

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|                        |                                                                   |                                                           |
|------------------------|-------------------------------------------------------------------|-----------------------------------------------------------|
| GEOLOGY                | - - - - -                                                         | J. F. WALKER, M.A., F.G.S.                                |
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| INSECTS AND CRUSTACEA  | - -                                                               | G. C. DENNIS.                                             |
| COMPARATIVE ANATOMY    | - -                                                               | T. ANDERSON, M.D., B.Sc.                                  |
| ORNITHOLOGY            | - - - : - -                                                       | J. BACKHOUSE, F.Z.S.,<br>M.B.O.U.                         |
| ANTIQUARIAN DEPARTMENT | { REV. W. GREENWELL, D.C.L.<br>F.R.S.<br>REV. CANON RAINE, D.C.L. |                                                           |
| BOTANY                 | - - - - -                                                         | H. J. WILKINSON.                                          |
| CONCHOLOGY             | - - - - -                                                         | REV. W. C. HEY, M.A.                                      |
| OBSERVATORY            | - - - - -                                                         | T. S. NOBLE.                                              |
| METEOROLOGY            | - - - - -                                                         | J. E. CLARK, B.A., B.Sc.                                  |
| LABORATORY             | - - - - -                                                         | J. F. WALKER, M.A., F.I.C.,<br>F.C.S., London and Berlin. |
| LIBRARY                | - - - - -                                                         | REV. JOHN HEY, M.A.                                       |

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THE HON. SECRETARY (*ex officio*).

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## KEEPER OF THE MUSEUM.

HENRY MAURICE PLATNAUER, A.R.S.M., B.Sc.

REPORT OF THE COUNCIL  
OF THE  
YORKSHIRE PHILOSOPHICAL SOCIETY,  
FEBRUARY 7TH, 1893.

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The Report of the Yorkshire Philosophical Society for the past year is upon the whole favourable. The gross Income of the Society for the year 1892 is £1225 0s. 0d., being slightly in excess of the Income of the past year, whilst the outgoings are nearly £50 below the expenditure, leaving a balance in the hands of the Treasurer of £39 6s. 2d. after taking into account the sum of £16 11s. 5d. due to the Treasurer at the close of last year's account. The Balance Sheet as certified by the Auditor, Mr Bryan Cookson of the Yorkshire Fire and Life Insurance Office, will be presented by the Treasurer after this Report is read, and attention will be drawn to some special items in connection with the receipts and expenditure.

ANTIQUARIAN DEPARTMENT.—During the past year the Antiquarian Department has made steady and satisfactory progress. The new edition of the Catalogue has been issued, which is much larger and more instructive than its predecessor. Some valuable additions have been made to the museum. Among these are two Roman inscriptions discovered on the Mount, and kindly presented by Mr. H. Riley Smith, the owner of the property on which they were found. Some curiosities have also come to the Museum from the new drainage works which are in progress in the city. The most conspicuous among these is a Roman coffin with its most interesting contents, discovered under the high road in Walmgate. A full account of this will be given in another place.

GEOLOGY.—During this year the Palæontological Collections have received as a bequest from our late Honorary Curator of Geology, a most important addition, the Elwes Collection of Tertiary Fossils. This acquisition raises our British Tertiary Collection to the second place in the Kingdom.

To our generous benefactor we are further indebted for a Collection of Scotch Carboniferous Polyzoa, a Collection of Australian Tertiary Fossils, a Collection of Pleistocene Mollusca and a number of useful and valuable works of reference relating chiefly to Geology and Zoology.

Mr. J. F. Walker has enriched our Yorkshire Jurassic Fauna by the addition of two species of Brachiopoda new to the County, and has added specimens of these species to the collection. Further reference to his discoveries will be found at the end of this Report.

Donations have also been received from Mr. J. E. Clark and Mr. Atkinson.

MINERALOGY.—Very little has been done in this department during the past year. The additions made to the collections have been limited to rock specimens. These consist of a few metamorphic and igneous rocks, and some specimens from the Kimberley mines.

CONCHOLOGICAL DEPARTMENT.—In last year's report the Curator announced the re-discovery of *Limnæa Glutinosa* in Yorkshire. This year he has secured some specimens for the Museum from the new locality, viz., the Skidby Drain, near Hull. Local specimens of another scarce shell, *Vertigo pusilla*, have also been added to the collection, found by the Honorary Curator on a moss-grown wall at Ayton.

He regrets that the general collection has not received any additions during the past year, especially as many genera are still unrepresented.

ENTOMOLOGY.—The Allis and Hey Collections are in good order.

The Honorary Curator is about to carry out a scheme for re-arranging the Insects in the Museum, in such a way as to

exhibit their structure and economic interest as well as their systematic classification. It is hoped that this re-arrangement will shortly be effected.

There are many gaps in the general collection, especially among the exotic Lepidoptera. The collection of Japanese butterflies presented some time back by Lieutenant Allenby will help to fill up some of these gaps, but insects from other parts of the world are much needed.

#### BOTANY, 1892—

*Phanerogamous Plants.*—Considerable progress has been made in the re-arrangement of the British specimens.

The Dalton, Middleton, and Hailstone Collections have been removed from the Library to the Keeper's Room, where they are arranged in the cabinet kindly provided by the Council.

The additions made during the year (1892) comprise a small collection of ferns from the Himalayas, presented by Mrs. Williamson, and a large portion of the Herbarium of the late Mr. Henry Baines, presented by Mr. Alfred W. Walker of York.

The latter collection is of especial interest to students of Yorkshire Botany, as it contains many specimens collected by Mr. Baines, and referred to (by him) in his celebrated "Flora of Yorkshire, 1840."

The specimens afford a pleasing reminiscence of Mr. Baines' connection with this Society, and the value of the collection is enhanced by the contributions of specimens from well known collectors.

*Cryptogamous Plants.*—The Curator states that the following orders are not represented in the Society's collection.

Musci, Hepaticæ, Fungi, Lichens.

The Legard Collection of Algæ is in good condition.

The Curator desires to record his thanks to Mr. Alfred Bennett, F.L.S., Croydon, for his kindness in examining and confirming the names of the Carices for the York Collection.

**LIBRARY.**—During the past year the Executors of the late

Mr. William Reed have handed over the books bequeathed to the Society by our generous benefactor. These books have been added to the Reference Library which very properly bears his name.

No other additions deserving of special notice have been made to the Library.

The work of cataloguing is progressing, and the Honorary Librarian hopes shortly to finish this very needful work.

PHOTOGRAPHIC SECTION.—The work of this section has been actively carried on during the past year, in spite of the retirement of a few prominent workers, owing to removal from York and other causes. On the whole it cannot be said that the section has received any accession to its numbers during this period; but the amount of work done in proportion to the number of members, evidently compares favourably with the average amount done by other photographic societies in towns of much the same population as York. The winter of 1891-2 was remarkable for the abnormal accumulations of hoar frost upon the trees, and in fact upon every object exposed to the outer air, most exquisitely beautiful scenes naturally resulting on every hand.

The Museum Gardens perhaps afford more opportunities for making photographic studies of hoar frost scenes than any other locality in York, and several members of the section made some most successful studies which will be lasting mememtos of that somewhat remarkable wintry period.

The monthly meetings of the section depend quite as much for their success upon informal discussions and enquiries concerning the every-day work of its individual members, as upon formal papers or practical demonstrations, although the latter types of sectional work perhaps afford the best material for a report intended for the perusal of members of the Yorkshire Philosophical Society generally. At the February meeting, Mr. W. Monkhouse gave a very practical demonstration of the process of making lantern transparencies by means of the very complete enlarging or reducing apparatus belonging to the Society, and which is independent of condensers, owing to the introduction of a system of illumin-

ating the negative devised by Mr. Monkhouse himself. At the March meeting, Mr. H. D. Taylor illustrated by means of some views of Welsh scenery, the advantages of using iso-chromatic plates in conjunction with a yellow glass screen placed in the lens, for by those means the various colours in a landscape view are registered at their proper relative value in the resulting negative or print, and atmospheric haze is no longer exaggerated, as in photographs taken on ordinary plates.

In April, the section gave their usual annual lantern slide exhibition, open to the Philosophical Society generally. This seemed to be very generally appreciated. After the usual summer vacation, the section resumed its work at the general annual meeting in October. The capital plan was then resolved upon of forming a portfolio periodically of photographic views and studies, contributed by various members, and specially selected for more than usual pictorial or artistic value, and submitting them to a professional artist for his written criticisms upon them, from an artistic point of view. This plan has been already started, and is likely to prove a very valuable means of instruction and guidance to those members who are trying to make photography something more than a merely mechanical recording process.

COMPARATIVE ANATOMY.—The collections in this department are in good order.

The only addition made during the year is a skeleton of the Wapiti (*Cervus canadensis*), obtained from a carcase presented to the Society by C. J. Leyland, Esq.

ORNITHOLOGICAL DEPARTMENT.—Although the total number of cases added to the new British Bird Collection is not large, some of the specimens they contain are worthy of special note. First and foremost should be mentioned a beautiful specimen of Baillon's Crake (*Porzana Bailloni*), the death of which is thus recorded in the "Naturalist" for October, 1892, by the Departmental Curator, as follows:—

"Year by year numbers of birds fall victims to the telegraph wires, and if these 'Patent Guillotines' continue to multiply as they are doing at present, many more casualties will

“doubtless occur. The number of scarce birds already on the  
“‘list of killed’ by wires in our county is considerable, and the  
“last which has come to my knowledge is among the scarcest.  
“An adult male, Baillon’s Crake (*Porzana Bailloni*) was picked  
“up under a wire between Pocklington and Wilberfoss last  
“Whitsuntide, and was sent to Mr. Allen, Bird-stuffer of  
“York, to preserve, who, notwithstanding the fact that the  
“bird had a great wound in the breast, has made a respectable  
“specimen, and very shortly it will appear (where all scarce  
“Yorkshire Birds should) in the new British Bird Collection  
“in York Museum. Previously some half dozen specimens  
“only of Baillon’s Crake appear to have been recorded from  
“Yorkshire.”

Another case contains a fine adult male Merlin, shot at Easington in Holderness, with an old female caught upon the Durham Moors near to the head waters of the River Tees.

A third case contains a pair of Hawfinches, obtained at Terrington near York, last winter.

METEOROLOGY.—1892 was chiefly notable for its coldness, the temperature being below the average in every month, except May and November. In July, October, and December, the deficiency exceeded 3°. The year’s mean, 45·8°, is 1·5° below the 50 years’ mean. The entire absence of warm intervals in the early months was very marked. This and associated peculiarities, especially in April, are discussed in the short paper appended to this Report. The extreme range, 71·5°, is a fraction greater than in the previous year. The maximum, 78·2° on June 9th, was remarkably early and bespeaks the absence of genial summer weather during the summer months. Frosts were again very numerous. So far as possible all cases of frost upon the ground are here included.

An additional table to show the variation of the present year from the 50 years’ mean, will materially assist in appreciating the matters here dealt with.

Mean pressure varied little from the average, and the extreme range was only 1·816 inches. Depressions were infrequent and on no occasion were they associated with violent gales.

The abundance of *bright sunshine*, 1350 hours or 166 more

than last year, is once more associated with a cold season, showing how much our warmth is due to the sun's rays shining elsewhere than in our own Islands.

The percentage for April (43) has only once before been exceeded in that month (44 per cent. in 1887), and besides in May, 1881 (54 per cent.), 1882 (55 per cent.), 1888 (45 per cent.), and June, 1889 (47 per cent.). December was sunnier than any year except 1886 (31 per cent.)

Rain or Snow, to an amount exceeding .005 inch of water, fell on 191 days, or 20 above the average. Yet the total Rainfall, 24.75 inches, is 0.25 less.

There was a deficiency in eight months, but the excessive rains in June and October (both more than double the average), brought the total thus near to the 50 years' average. The maximum falls in these months (1.71 and 1.77), were only once surpassed since 1875. That a third fall of over an inch should be recorded (1.14 in May), is the more remarkable, since only five such, on the average, occur in each four years.

The remarkable 42 hours' Rainfall, October 13th, 14th, 15th, and consequent floods, are sufficiently discussed elsewhere. Except on this date the river was never high. Summer level was recorded twice in July, two or three times in connexion with the frequent withdrawal of water from September to December, and three times during the severe frost which closed this latter month.

In the Paper on "Fifty years of York Meteorology" in last year's Report, attention was drawn to the fact that at sunspot maxima, June, September, and October showed a decided tendency to excessive rain, and August the reverse to an even more marked degree. Without wishing to insist too much on isolated cases, it is suggestive that this year should have brought us two such exceptional falls as those mentioned, whilst August fell rather below its average.

The cumulative totals for the three wettest months from 1871 are August 141.33 inches, October 139.00, July 137.28; next comes September 122.38.

An additional column headed "*visibility*," accompanies the present tables. For ten years now, this has been compared by noting the West Riding Hills from Feversham Terrace.

Values 1, 2, and 3 are assigned according as they are "visible," "clear," or "very clear." Absence in July leaves a blank for that month. For the first time they were seen in December. The year was unusually clear, April and May remarkably so. March was much below the average.

*Auroras* were notably frequent in the Spring, but less conspicuous in the Autumn, when the number of sunspots unexpectedly began to fall off. Eighteen were recorded in all, or the same number as last year. The dates were, January 2nd, 24th, 30th, February 13th, 20th, March 28th, April 25th, 30th, May 1st, 25th, August 12th and 24th, September 21st, 28th, October 13th, 17th, 18th, December 11th, 16th. That of April 25th was very fine; so also were those of January 2nd and August 12th, as seen in Yorkshire. Mock Suns were noted on March 6th, April 1st, 4th, 30th, and December 7th. The much rarer Mock Moon was seen on May 1st.

We are again indebted to Henry Richardson, Esq., for additional tables of Rainfall, and to Richard Thompson, Esq., for additional tables of Bright Sunshine. Although the *total* for the latter at Oswaldkirk was nearly fifty hours less, the *per-centage* was greater. This was because of the usual winter excess, 58 hours having been recorded in December, or 29 per cent.

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The following Lectures have been given in the Museum during the past year:—

Thursday February 11th, February 18th, and February 25th.

A Course of Lectures on

"Earth-Wasting and Earth-Building," (Illustrated by Lantern Views).

I.—"The Work of the Air."

II.—"The Work of the Ocean."

III.—"Subterranean Forces."

- By the Keeper of the Museum, H. M. PLATNAUER, B.Sc., F.G.S.
- Thursday, March 3rd. "Southern Iceland," by FREDK. W. W. HOWELL, F.R.G.S. (Illustrated by original Lantern Views).
- „ „ 10th. "A Visit to some of the York Hospitals," by J. S. ROWNTREE, J.P.
- „ „ 17th. "Shakesperian Songs and Ballads," by WALTER ROWLEY, F.S.A.
- „ „ 24th. "Morocco and the Moors," by H. BENDELACK HEWETSON, F.L.S., F.Z.S. (Illustrated by original Lantern Views).
- „ „ 31st. "Teneriffe," by TEMPEST ANDERSON, M.D., B.Sc. (Illustrated by original Lantern Views).
- „ April 7th. "The Eastern Caucasus," by GEO. YELD, M.A., A.C. (Illustrated by Lantern Views).

On April 28th the Photographic Section gave a Lantern Night.

- Thursday, Oct. 27th. "New Zealand," (illustrated by Lantern Pictures), by MAJOR BARSTOW.
- „ Nov. 3rd. "Man's Influence on Nature." (No. I.) (Illustrated by Lantern Pictures), by H. M. PLATNAUER, B.Sc.
- „ „ 10th. "A Visit to Venice and Italian Lakeland with a Kodak, (illustrated by Lantern Pictures), by the Rev. T. GOUGH, B.Sc.
- „ „ 17th. "Man's Influence on Nature," (No. II.) (Illustrated by Lantern Pictures), by H. M. PLATNAUER, B.Sc.
- „ „ 24th. "The East Yorkshire Dialect," by the Rev. C. F. MARMADUKE MORRIS, M.A., B.C.L.
- „ Dec. 1st. "Through Cyprus on Horseback," (Illustrated by Lantern Pictures), by the Rev. J. H. WICKSTEED, M.A.
- „ „ 8th. A Conversazione was held in the Museum.

23 New Members, 2 Lady Subscribers, 4 Associates and 2 Temporary have been added to the Society during the past year, whilst the Society has lost by death 10 members, and by resignation 38 Members, 5 Lady Subscribers and 6 Associates.

The Council propose for election as Vice-Presidents, Major J. A. Barstow and G. S. Gibb, Esq.

The Council propose for election as New Members of the Council :—Mr. C. E. Elmhirst, Rev. E. S. Carter, Dr. Collins, and Mr. Alderman Milward, in the room of Mr. F. L. Mawdesley, deceased, and Major Barstow, Mr. J. E. Clark and Mr. G. S. Gibb, who retire by rotation ; and Mr. H. Copperthwaite in the room of Mr. A. Worsley, who has resigned his membership of the Society.

Within little over a year the Society has lost three honorary members, a brief reference to whom will not be out of place here.

Foremost among these is Sir Richard Owen. To attempt a description of this famous anatomist's work, which for amount and wideness of range is almost unequalled, would be impossible in this Report. It is sufficient here to say that he was for many years an honorary member of this Society, and that our three great Saurian skeletons and Jurassic mammalian jaw were originally described by him.

The death of Sir Andrew Crombie Ramsay makes a gap in the roll of eminent men of science. His work on the Geological Survey of Great Britain extended over forty years, during the last ten years of which period he held the post of Director-General. The value of this work, both to the Survey and to Science in general, can scarcely be over-rated.

Dr. Ferdinand Roemer had the advantage of working over a much wider field than his British fellow-geologist. He wrote exhaustive works on the Geology of Texas and of Silesia, and conceived the bold idea of exploring all the Devonian rocks of Europe. This scheme he actually carried out ; beginning with the classic red sandstones of Devonshire, he followed the Devonian formation right across the Continent to the shores of the Bosphorus.

By the death of Mr. William Reed, Honorary Curator of Geology, and Vice-President, the Society has suffered a severe

loss. Mr. Reed is too well known to all members of this Society to render any biographical notice necessary, and in this museum his generosity is so much in evidence that no detailed list of his gifts is needed. But it may not be generally known that our late benefactor bequeathed us all his fossils, all his scientific books, and that he further left £600 in trust, the interest on which sum was to be spent in the purchase of books and fossils for the museum.

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STATION, YORK.—THE MUSEUM.

Longitude 1° 5' W., Latitude 53° 57' N. Height above Mean Sea Level 51 feet.

| 1892.     | Highest<br>Barometer.       | Lowest<br>Barometer.       | Mean<br>Pressure<br>at 32°<br>Fahren-<br>heit at<br>M.S Level | Air Temperature. |           |           |           |           |                        | Humidity.      |           |                      |          |                    |        |             |           |           |         |         |         |   |     |   |   |
|-----------|-----------------------------|----------------------------|---------------------------------------------------------------|------------------|-----------|-----------|-----------|-----------|------------------------|----------------|-----------|----------------------|----------|--------------------|--------|-------------|-----------|-----------|---------|---------|---------|---|-----|---|---|
|           |                             |                            |                                                               | 9 a.m.           | 9 p.m     | Mean.     | Means of  |           | Absolute Min. and Max. |                | 9 a.m.    | 9 p.m.               | Mean.    | Tension of Vapour. |        |             |           |           |         |         |         |   |     |   |   |
|           |                             |                            |                                                               |                  |           |           | Min.      | Max.      | Min.                   | Max.           |           |                      |          | 9 a.m.             | 9 p.m. | Mean.       | 9 a.m.    | 9 p.m.    | Mean.   |         |         |   |     |   |   |
|           |                             |                            |                                                               |                  |           |           |           |           |                        |                |           |                      |          |                    |        |             |           |           |         | in.     | °       | ° | in. | ° | ° |
|           |                             |                            |                                                               |                  |           |           |           |           |                        |                |           |                      |          |                    |        |             |           |           |         |         |         |   |     |   |   |
| January   | 25th, 9 p.m. 30·453         | 7th, 9 p.m. 29·261         | ins.<br>29·806                                                | °<br>35·7        | °<br>36·1 | °<br>35·9 | °<br>30·2 | °<br>40·6 | °<br>13·4              | 16th           | °<br>53·3 | 29th                 | °<br>1·1 | 1·1                | 1·1    | in.<br>·190 | °<br>·192 | °<br>·191 | °<br>90 | °<br>90 | %<br>90 |   |     |   |   |
| February  | 13th, 9 a.m. 30·570         | 2nd, 6 p.m. 28·841         | 29·776                                                        | 36·5             | 37·7      | 37·1      | 31·6      | 43·2      | 6·7                    | 19th           | 55·0      | 12th                 | 1·0      | 1·2                | 1·1    | ·197        | ·203      | ·200      | 92      | 90      | 91      |   |     |   |   |
| March     | 30th, 9 a.m. 30·657         | 10th, 8 a.m. 29·181        | 30·053                                                        | 36·4             | 36·1      | 36·3      | 30·4      | 45·0      | 20·0                   | 12th           | 67·5      | 31st                 | 1·6      | 1·3                | 1·5    | ·185        | ·188      | ·187      | 86      | 88      | 87      |   |     |   |   |
| April     | 1st, 8 a.m. 30·471          | 27th, 6 p.m. 29·455        | 30·023                                                        | 44·5             | 42·5      | 43·5      | 34·4      | 55·2      | 24·0                   | 16th           | 71·3      | 1st                  | 3·0      | 2·1                | 2·6    | ·229        | ·228      | ·229      | 78      | 84      | 81      |   |     |   |   |
| May       | 12th, 9 a.m. 30·473         | 16th, 9 p.m. 29·447        | 29·967                                                        | 53·0             | 51·1      | 52·1      | 43·8      | 61·0      | 33·0                   | 1st            | 76·0      | 31st                 | 3·9      | 2·8                | 3·4    | ·301        | ·305      | ·303      | 75      | 81      | 78      |   |     |   |   |
| June      | 8th, 9 a.m. 30·434          | 2nd, 9 a.m. 29·553         | 29·973                                                        | 56·2             | 53·2      | 54·7      | 47·4      | 63·2      | 36·8                   | 18th           | 78·2      | 9th                  | 3·7      | 2·5                | 3·1    | ·350        | ·338      | ·344      | 77      | 83      | 80      |   |     |   |   |
| July      | 24th, 9 a.m. 30·386         | 7th, 9 a.m. 29·287         | 30·012                                                        | 57·3             | 55·6      | 56·5      | 50·0      | 63·9      | 43·0                   | { 11th<br>21st | 77·1      | 3rd                  | 3·9      | 2·7                | 3·3    | ·358        | ·367      | ·363      | 76      | 82      | 79      |   |     |   |   |
| August    | 10th, 9 a.m. 30·266         | 30th, 9 p.m. 29·352        | 29·865                                                        | 59·2             | 57·7      | 58·5      | 51·9      | 66·2      | 43·0                   | 11th           | 76·4      | 23rd                 | 3·3      | 2·3                | 2·8    | ·402        | ·409      | ·406      | 80      | 85      | 83      |   |     |   |   |
| September | 22nd, 9 a.m. 30·307         | 30th, 9 p.m. 29·386        | 29·902                                                        | 54·4             | 52·1      | 53·3      | 45·9      | 60·8      | 37·6                   | 5th            | 67·0      | 13th                 | 3·0      | 2·4                | 2·7    | ·340        | ·327      | ·334      | 80      | 83      | 82      |   |     |   |   |
| October   | 18th, 9 p.m. 30·337         | 9th, 6 p.m. 29·103         | 29·682                                                        | 44·0             | 43·7      | 43·9      | 38·7      | 50·9      | 25·0                   | 26th           | 59·7      | 29th                 | 1·9      | 1·3                | 1·6    | ·246        | ·256      | ·251      | 85      | 89      | 87      |   |     |   |   |
| November  | 22nd, 9 a.m. 30·445         | 3rd, 9 a.m. 29·533         | 30·002                                                        | 42·0             | 44·0      | 43·0      | 38·6      | 48·3      | 25·0                   | 2nd            | 55·0      | { 3rd<br>5th<br>15th | 1·0      | 1·2                | 1·1    | ·245        | ·261      | ·253      | 92      | 90      | 91      |   |     |   |   |
| December  | 27th, 9 p.m. 30·295         | 11th, 6 . . 29·237         | 29·945                                                        | 33·4             | 34·6      | 34·0      | 29·7      | 39·2      | 13·0                   | 27th           | 54·0      | 18th                 | 0·7      | 0·8                | 0·8    | ·177        | ·185      | ·181      | 92      | 93      | 93      |   |     |   |   |
| Year      | Mar. 30th, 30·657<br>9 a.m. | Feb. 2nd, 28·841<br>6 p.m. | 29·917                                                        | 46·1             | 45·4      | 45·8      | 39·4      | 53·1      | 6·7                    | Feb.<br>19th.  | 78·2      | June 9               | 2·3      | 1·8                | 2·1    | ·268        | ·272      | ·270      | 83·6    | 86·5    | 85·1    |   |     |   |   |

STATION, YORK.—THE MUSEUM.

Barometer 2 feet above ground. Thermometers 4 feet 3 inches above ground. Rain-gauge 1 foot 9 inches above ground (49 feet at rim above sea-level).

| 1892.     | Amount of Cloud. |        |      | Rainfall. |          | Sunshine Returns. |                    | Mean Hours 1881-90. | Mean Per-centage 1881-90. | Weather, No. of Days of |       |       |                 |           |           |      |              | Wind, No. of Observations of |      |     |      |    |      |     |      |      |    |   |
|-----------|------------------|--------|------|-----------|----------|-------------------|--------------------|---------------------|---------------------------|-------------------------|-------|-------|-----------------|-----------|-----------|------|--------------|------------------------------|------|-----|------|----|------|-----|------|------|----|---|
|           | 9 a.m.           | 9 p.m. | Mean | Total.    | Max.     | Day               | Total hours. 1892. | Per-centage. 1892.  |                           | Frosts.                 | Snow. | Hail. | Thun-der Storms | Clear Sky | Over-cast | Gale | Visi-bility. | N.                           | N.E. | E.  | S.E. | S. | S.W. | W.  | N.W. | Calm |    |   |
|           |                  |        |      |           |          |                   |                    |                     |                           |                         |       |       |                 |           |           |      |              |                              |      |     |      |    |      |     |      |      |    |   |
| January   | 7.0              | 6.7    | 6.9  | ins. 1.07 | ins. .45 | 10th              | 34                 | 14                  | 25.6                      | 10.6                    | 13    | 5     | 0               | 0         | 4         | 14   | 0            | 5                            | 11   | 2   | 8    | 4  | 5    | 3   | 24   | 4    | 1  |   |
| February  | 6.6              | 6.3    | 6.5  | 1.64      | .39      | 20th              | 67                 | 24                  | 53.1                      | 19.5                    | 23    | 5     | 0               | 0         | 4         | 13   | 0            | 1                            | 10   | 6   | 10   | 2  | 5    | 3   | 16   | 6    | 0  |   |
| March     | 6.4              | 5.4    | 5.9  | 0.93      | .35      | 9th               | 128                | 35                  | 98.6                      | 26.9                    | 13    | 10    | 0               | 0         | 5         | 11   | 0            | 3                            | 11   | 5   | 12   | 5  | 9    | 1   | 11   | 8    | 0  |   |
| April     | 5.0              | 4.1    | 4.6  | 1.48      | .63      | 27th              | 179                | 43                  | 128.0                     | 30.6                    | 12    | 7     | 1               | 0         | 6         | 5    | 1            | 25                           | 22   | 7   | 6    | 3  | 4    | 2   | 10   | 6    | 0  |   |
| May       | 6.7              | 6.0    | 6.4  | 2.94      | 1.14     | 27th              | 185                | 38                  | 187.1                     | 37.8                    | 20    | 0     | 1               | 4         | 4         | 10   | 1            | 16                           | 8    | 7   | 10   | 2  | 8    | 6   | 19   | 2    | 0  |   |
| June      | 6.1              | 5.4    | 5.8  | 4.69      | 1.71     | 28th              | 192                | 38                  | 168.6                     | 33.5                    | 16    | 0     | 1               | 3         | 5         | 7    | 0            | 11                           | 11   | 2   | 5    | 4  | 8    | 6   | 18   | 6    | 0  |   |
| July      | 6.6              | 6.9    | 6.8  | 1.37      | .61      | 19th              | 121                | 24                  | 161.5                     | 32.1                    | 11    | 0     | 0               | 1         | 2         | 12   | 1            | —                            | 8    | 11  | 15   | 1  | 7    | 4   | 14   | 2    | 0  |   |
| August    | 6.5              | 7.1    | 6.8  | 2.67      | .79      | 7th               | 131                | 29                  | 147.7                     | 32.5                    | 19    | 0     | 0               | 0         | 1         | 12   | 0            | 3                            | 6    | 1   | 4    | 6  | 16   | 5   | 16   | 7    | 1  |   |
| September | 5.8              | 5.7    | 5.8  | 1.06      | .22      | 1st               | 136                | 36                  | 105.4                     | 28.1                    | 16    | 0     | 0               | 0         | 3         | 7    | 0            | 8                            | 5    | 3   | 1    | 0  | 20   | 7   | 20   | 3    | 1  |   |
| October   | 4.8              | 5.2    | 5.0  | 4.80      | 1.77     | 14th              | 100                | 31                  | 80.5                      | 25.1                    | 23    | 10    | 0               | 0         | 6         | 8    | 1            | 6                            | 15   | 1   | 6    | 6  | 9    | 1   | 13   | 10   | 1  |   |
| November  | 7.5              | 8.4    | 8.0  | 1.53      | .45      | 13th              | 34                 | 14                  | 42.1                      | 16.9                    | 14    | 10    | 0               | 0         | 3         | 21   | 0            | 0                            | 6    | 2   | 7    | 11 | 19   | 3   | 8    | 2    | 2  |   |
| December  | 5.3              | 5.2    | 5.3  | 0.57      | .15      | 8th               | 43                 | 19                  | 24.5                      | 10.5                    | 11    | 21    | 2               | 0         | 7         | 9    | 0            | 1                            | 12   | 0   | 2    | 5  | 19   | 5   | 11   | 7    | 1  |   |
| Year      | 6.2              | 6.0    | 6.1  | 24.75     | 1.77     |                   | 1350               | 28.8                | 1222.7                    | 26.75                   | 191   | 133   | 26              | 3         | 8         | 50   | 129          | 4                            | 79   | 125 | 47   | 86 | 49   | 129 | 46   | 180  | 63 | 7 |

HEIGHT OF THE RIVER OUSE AT OUSE BRIDGE DURING 1892.

| Date. | JANUARY. |     | FEBRUARY. |     | MARCH. |     | APRIL. |     | MAY.  |     | JUNE. |     | JULY. |     | AUGUST. |     | SEPTEMBER. |            | OCTOBER.   |            | NOVEMBER.  |     | DECEMBER. |            |
|-------|----------|-----|-----------|-----|--------|-----|--------|-----|-------|-----|-------|-----|-------|-----|---------|-----|------------|------------|------------|------------|------------|-----|-----------|------------|
|       | Feet.    | In. | Feet.     | In. | Feet.  | In. | Feet.  | In. | Feet. | In. | Feet. | In. | Feet. | In. | Feet.   | In. | Feet.      | In.        | Feet.      | In.        | Feet.      | In. | Feet.     | In.        |
| 1     | 3        | 2   | 2         | 6   | 1      | 6   | 1      | 0   | 0     | 6   | 1     | 6   | 1     | 10  | 0       | 0   | 5          | 5          | 1          | 0          | 1          | 3   | 1         | 2          |
| 2     | 1        | 6   | 3         | 10  | 1      | 6   | 1      | 0   | 0     | 10  | 0     | 6   | 1     | 6   | 0       | 0   | 1          | 6          | 1          | 0          | 1          | 3   | 1         | 6          |
| 3     | 0        | 6   | 1         | 7   | 1      | 2   | 0      | 10  | 0     | 6   | 0     | 6   | 1     | 0   | 0       | 0   | 8          | 8          | Water off. |            | 1          | 2   | 1         | 0          |
| 4     | 1        | 4   | 1         | 0   | 0      | 0   | 0      | 10  | 1     | 0   | 0     | 10  | 1     | 10  | 0       | 0   | 2          | 2          | 5          | 2          | 1          | 6   | 1         | 0          |
| 5     | 0        | 9   | 0         | 10  | 0      | 3   | 0      | 9   | 0     | 4   | 0     | 6   | 1     | 2   | 0       | 0   | 1          | 6          | 2          | 2          | 4          | 0   | 1         | 0          |
| 6     | 1        | 3   | 2         | 4   | 1      | 0   | 0      | 9   | 0     | 4   | 2     | 0   | S.L.  |     | 0       | 0   | 1          | Water off. | Water off. |            | 1          | 6   | 0         | 2          |
| 7     | 0        | 7   | 1         | 6   | 1      | 0   | 0      | 0   | 1     | 0   | 1     | 0   | 1     | 0   | 0       | 0   | 0          | 10         | 1          | 0          | 2          | 0   | 1         | 0          |
| 8     | 1        | 0   | 5         | 6   | 1      | 6   | 0      | 10  | 0     | 6   | 0     | 9   | 2     | 6   | 0       | 0   | 2          | 0          | 1          | 2          | 2          | 0   | 1         | 0          |
| 9     | 1        | 3   | 3         | 2   | 1      | 0   | 0      | 10  | 0     | 6   | 0     | 7   | 1     | 0   | 4       | 0   | 1          | 0          | 1          | 2          | 1          | 8   | 0         | 10         |
| 10    | 1        | 0   | 2         | 0   | 1      | 0   | 0      | 10  | 0     | 6   | 0     | 6   | 1     | 0   | 1       | 3   | 1          | 2          | 1          | 0          | 1          | 0   | 0         | 9          |
| 11    | 1        | 0   | 1         | 6   | 0      | 0   | 0      | 6   | 0     | 6   | 0     | 5   | 1     | 0   | 0       | 9   | 0          | 0          | 7          | 6          | 1          | 0   | 0         | 9          |
| 12    | 0        | 7   | 1         | 6   | 0      | 10  | 0      | 6   | 0     | 6   | 0     | 6   | 1     | 3   | 0       | 7   | 0          | 10         | 1          | 6          | 1          | 1   | 0         | 9          |
| 13    | 0        | 7   | 1         | 6   | 0      | 10  | 0      | 6   | 0     | 6   | 1     | 0   | 0     | 0   | 0       | 3   | 0          | 10         | 1          | 3          | S.L.       | 1   | 10        |            |
| 14    | 0        | 7   | 1         | 0   | 0      | 10  | 0      | 6   | 0     | 6   | 1     | 0   | 0     | 3   | 0       | 6   | 0          | 6          | 1          | 0          | Water off. | 2   | 0         |            |
| 15    | 0        | 11  | 1         | 0   | 0      | 10  | 0      | 6   | 0     | 6   | 1     | 6   | S.L.  |     | 1       | 6   | 0          | 6          | 1          | 0          | 1          | 2   | 0         |            |
| 16    | 0        | 7   | 1         | 10  | 0      | 11  | 0      | 6   | 0     | 6   | 0     | 6   | 0     | 6   | 0       | 5   | 1          | 6          | 10         | 6          | 2          | 0   | 0         |            |
| 17    | 0        | 6   | 1         | 0   | 1      | 6   | 0      | 6   | 0     | 6   | 0     | 10  | 0     | 7   | 0       | 1   | 0          | 6          | *15        | 10         | 2          | 0   | 4         | 0          |
| 18    | 0        | 6   | 1         | 0   | 2      | 7   | 0      | 9   | 0     | 6   | 0     | 0   | 0     | 3   | 0       | 0   | 0          | 6          | 14         | 5          | 1          | 3   | 3         | 0          |
| 19    | 1        | 5   | 0         | 10  | 0      | 7   | 0      | 9   | 1     | 3   | 0     | 6   | 0     | 7   | 1       | 3   | 0          | 6          | 12         | 0          | 1          | 4   | 4         | 0          |
| 20    | 2        | 2   | 1         | 0   | 1      | 0   | 0      | 6   | 1     | 0   | 1     | 0   | 0     | 6   | 1       | 2   | 0          | 7          | 9          | 6          | 1          | 0   | 2         | 4          |
| 21    | 1        | 3   | 1         | 0   | 1      | 0   | 0      | 9   | 1     | 0   | 3     | 0   | 0     | 10  | 0       | 0   | 1          | 10         | 5          | 6          | S.L.       | 0   | 0         |            |
| 22    | 0        | 11  | 2         | 2   | 2      | 6   | 0      | 10  | 2     | 10  | 3     | 10  | 1     | 0   | 0       | 0   | 3          | 0          | 3          | 0          | 0          | 11  | 1         | Water off. |
| 23    | 1        | 4   | 3         | 0   | 1      | 0   | 1      | 0   | 1     | 0   | 0     | 6   | 0     | 6   | 0       | 0   | 0          | 11         | 3          | 10         | 0          | 10  | 0         |            |
| 24    | 2        | 6   | 4         | 0   | 1      | 6   | 0      | 2   | 1     | 0   | 0     | 6   | 0     | 6   | 0       | 0   | 0          | 7          | 2          | 3          | 1          | 0   | S.L.      | 6          |
| 25    | 4        | 0   | 4         | 3   | 1      | 0   | 0      | 10  | 1     | 3   | 0     | 6   | 0     | 6   | 0       | 0   | 0          | 6          | 1          | 10         | 1          | 0   | 0         |            |
| 26    | 1        | 10  | 2         | 6   | 1      | 6   | 0      | 6   | 1     | 6   | 6     | 6   | 0     | 6   | 0       | 0   | 1          | 6          | 1          | 6          | 1          | 0   | S.L.      |            |
| 27    | 2        | 2   | 3         | 4   | 0      | 9   | 0      | 6   | 1     | 3   | 0     | 6   | 0     | 6   | 0       | 0   | S.L.       | Water off. | 1          | 3          | 0          | 6   | 0         | 6          |
| 28    | 7        | 10  | 1         | 6   | 0      | 10  | 1      | 3   | 2     | 5   | S.L.  | 10  | 0     | 6   | 3       | 10  | Water off. | 6          | 0          | Water off. | 1          | 3   | 0         |            |
| 29    | 5        | 0   | 1         | 6   | 0      | 10  | 0      | 0   | 5     | 0   | 2     | 6   | 0     | 6   | 0       | 0   | "          | 6          | 6          | 0          | 2          | 6   | S.L.      | 9          |
| 30    | 4        | 3   | 0         | 9   | 0      | 9   | 0      | 10  | 1     | 3   | 6     | 0   | 0     | 6   | 6       | 0   | "          | 6          | 5          | 0          | 0          | 6   | 0         | 0          |
| 31    | 3        | 2   |           |     | 1      | 0   | 0      | 10  | 1     | 0   | 1     | 6   | 0     | 6   | 4       | 10  | 1          | 6          | 2          | 0          | 1          | 6   | 1         | 0          |

\*16 ft. 6 in. was given ; but 15 ft. 10 in. is, as a fact, the correct height for Ouse Bridge.

SUPPLEMENTARY RETURNS

SUPPLIED BY

H. RICHARDSON, ESQ., AND R. THOMPSON, ESQ.

|        | RAINFALL, CHERRY HILL, YORK. |                             |       |                                                | CHERRY BANK ILKLEY.   | BRIGHT SUNSHINE, THE HERMITAGE, OSWALDKIRK |                                   |
|--------|------------------------------|-----------------------------|-------|------------------------------------------------|-----------------------|--------------------------------------------|-----------------------------------|
| Month. | 1892. Monthly Totals.        | Greatest depth in 24 hours. |       | Number of days on which .01 or more rain fell. | 1892. Monthly Totals. | Hours.                                     | Percentage of actual to possible. |
|        | Inches.                      | Inches.                     | Date. |                                                | Inches.               |                                            |                                   |
| Jan.   | .96                          | .43                         | 10th  | 12                                             | 1.58                  | 39.20                                      | 16.27                             |
| Feb.   | 1.67                         | .38                         | 20th  | 19                                             | 3.33                  | 70.66                                      | 26.46                             |
| Mar.   | .98                          | .44                         | 9th   | 14                                             | 1.09                  | 142.25                                     | 39.08                             |
| April  | 2.05                         | 1.21                        | 14th  | 11                                             | 1.79                  | 181.00                                     | 43.30                             |
| May    | 2.78                         | 1.05                        | 27th  | 20                                             | 3.30                  | 166.50                                     | 33.84                             |
| June   | 4.62                         | 1.68                        | 28th  | 15                                             | 4.85                  | 160.75                                     | 31.77                             |
| July   | 1.37                         | .57                         | 19th  | 11                                             | 1.97                  | 122.40                                     | 24.19                             |
| Aug.   | 2.55                         | .79                         | 7th   | 18                                             | 4.41                  | 120.80                                     | 26.55                             |
| Sept.  | .95                          | .20                         | 1st   | 15                                             | 2.54                  | 120.80                                     | 32.30                             |
| Oct.   | 4.66                         | 1.66                        | 14th  | 23                                             | 7.05                  | 76.95                                      | 24.05                             |
| Nov.   | 1.46                         | .49                         | 13th  | 16                                             | 2.21                  | 42.90                                      | 17.23                             |
| Dec.   | .49                          | .15                         | 8th   | 11                                             | 1.3                   | 58.30                                      | 26.26                             |
| Total  | 24.54                        |                             |       | 185                                            | 35.49                 | 1302.51                                    | 29.00                             |

# DIFFERENCES IN 1892 FROM MEANS.

Columns 1—6 for fifty years, 1841—90; Columns 7—10 for ten years.

|       | Mean<br>Barometer. | Thermometer. |       |                  | Rain.  | Rainy<br>Days. | Mean<br>Rel.<br>Humidy. | Sunshine. |                  | Visibility. |
|-------|--------------------|--------------|-------|------------------|--------|----------------|-------------------------|-----------|------------------|-------------|
|       |                    | Min.         | Max.  | Mean<br>of both. |        |                |                         | Hours.    | Per-<br>centage. |             |
| Jan.  | — 0·05             | — 2·0        | — 0·9 | — 1·5            | — 0·67 | — 1½           | — 0·7                   | + 8½      | + 3·4            | + 3·1       |
| Feb.  | — 0·14             | — 1·4        | — 0·3 | — 0·8            | + 0·12 | + 10           | + 2·6                   | + 14      | + 4·5            | — 1·0       |
| Mar.  | + 0·17             | — 3·7        | — 2·0 | — 2·9            | — 0·74 | — 1            | + 0·7                   | + 29½     | + 8·1            | — 2·9       |
| April | + 0·12             | — 3·6        | + 1·6 | — 1·1            | — 0·13 | — 1½           | — 0·2                   | + 51      | + 12·4           | + 17·7      |
| May   | + 0·02             | + 0·9        | + 1·4 | + 1·1            | + 1·13 | + 7            | + 0·9                   | — 2       | + 0·2            | + 9·7       |
| June  | + 0·01             | — 1·8        | — 2·8 | — 2·3            | + 2·45 | + 3½           | + 2·5                   | + 23½     | + 4·5            | + 5·9       |
| July  | — 0·09             | — 2·1        | — 4·3 | — 3·2            | — 1·29 | — 2½           | + 0·1                   | — 40½     | — 8·1            | —           |
| Aug.  | — 0·05             | 0            | — 1·1 | — 0·6            | — 0·02 | + 5            | + 1·7                   | — 16½     | — 3·5            | — 1·7       |
| Sept. | — 0·02             | — 1·9        | — 1·6 | — 1·8            | — 1·34 | + 2½           | — 3·9                   | + 30½     | + 7·5            | + 2·4       |
| Oct.  | — 0·16             | — 3·1        | — 3·6 | — 3·3            | + 2·18 | + 6            | — 0·6                   | + 19½     | + 5·9            | + 2·2       |
| Nov.  | + 0·13             | — 2·3        | — 1·5 | + 1·8            | — 0·56 | — 2½           | + 1·8                   | — 8       | — 2·9            | — 0·3       |
| Dec.  | + 0·04             | — 3·3        | — 3·2 | — 3·3            | — 1·39 | — 4            | + 2·4                   | + 18½     | + 8·5            | + 0·9       |
| Year  | + 0·013            | — 1·6        | — 1·3 | — 1·5            | — 0·26 | + 21           | + 0·6                   | + 127     | + 2·1            | + 36·0      |

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FOR THE YEAR ENDING 31<sup>ST</sup> DECEMBER, 1892.

EDWIN GRAY, Hon. Treasurer

York, 6th February, 1893.

BRYAN ED. COOKSON

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| The Memoirs and Proceedings of Manchester Literary and Philosophical Society, vol. v., Nos. 1 & 2.                                                                                                                                                                                                                                        | The Society.                          |
| Catalogue of Prehistoric Works East of the Rocky Mountains, by Cyrus Thomas, and Omaha, and Ponka Letters by J. O. Dorsey.                                                                                                                                                                                                                | The Smithsonian Institution.          |
| The Final Report of the United States Geological Survey of Nebraska, 1872, and Geological Survey of Indiana, 1869, by E. T. Cox.                                                                                                                                                                                                          | Tempest Anderson, M.D.                |
| The Proceedings and Transactions of the Nova Scotian Institute of Science, vol. i., part i.                                                                                                                                                                                                                                               | The Institute.                        |
| The Tenth Annual Report of the United States Geological Survey, Geology, part i., Irrigation, part ii.                                                                                                                                                                                                                                    | The United States Geological Survey.  |
| Harmonic Analysis of Hourly Observations of Air Temperature and Pressure at British Observatories, Hourly Readings of the self recording Instruments, Ten Years' Sunshine in the British Isles, 1881-1890. Report of Council to the Royal Society for the Year ending 31st of March, 1891, and Daily and Weekly Weather Reports for 1892. | The Meteorological Society of London. |
| The Transactions of the Zoological Society of London, vol. xiii., part 4, Proceedings, part 4, 1891, parts 1, 2, 3, 1892, and Proceedings of Scientific Meetings with Index 1881-1890.                                                                                                                                                    | The Society.                          |
| The Records of the Geological Survey of New South Wales, vol. ii., part 4, vol. iii., part 1, and Annual Reports of the Australian Museum for the Years 1890-91.                                                                                                                                                                          | The Department of Mines, Sydney.      |
| The Proceedings of the Royal Institution of Great Britain, vol. xiii., part 2., No. 85.                                                                                                                                                                                                                                                   | The Institution.                      |

| BOOKS PRESENTED.                                                                                                                               | DONORS.             |
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| The Journal of the Manchester Geographical Society, vol. vii., Nos. 4 to 12.                                                                   | The Society.        |
| A Monograph of the British Jurassic Gasteropoda, part 1, No. 5, by W. H. Hudleston, M.A., F.R.S.                                               | The Author.         |
| The Memoirs of the Egypt Exploration Fund, Festival Hall of Osorkon, part 2, Naukratis, part 2, and special extra report of the season's work. | W. W. Morrell, Esq. |
| Nova acta der Kaisl. Carol. Deutschen Akademie der Naturforscher Bd lvii., Nrs. 3, 4, Leopoldina Bd xxvii.                                     | The Academy.        |
| The Transactions of the Leicester Literary and Philosophical Society, New Series, vol. ii., part 10.                                           | The Society.        |
| Report of the Norwegian North Atlantic Expedition, 1876-78. The Crinoidea by D. C. Danielssen.                                                 | The Commission.     |
| A Catalogue of British Jurassic Gasteropoda 1892, by W. H. Hudleston and Wilson.                                                               | The Authors.        |
| The Proceedings of the Bristol Naturalists' Society, New Series, vol. vii., part 1.                                                            | The Society.        |
| The Bulletin of the University of Nebraska, Agricultural Experiment Station, vol. v., No. 3 and 5th Annual Report.                             | The University.     |
| The Transactions of the Wisconsin Academy of Sciences, Arts, and Letters, vol. viii., 1888-90.                                                 | The Academy.        |
| Mittheilungen des Vereins für Erdkunde zu Leipzig, 1891.                                                                                       | The Society.        |
| Det kongelige Norske Videnskabers Selskabs Skrifter, 1888-90.                                                                                  | The Society.        |
| The Transactions of the New Zealand Institute, 1891.                                                                                           | The Institute.      |

| BOOKS PRESENTED.                                                                                                                               | DONORS.          |
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| The Transactions of the Natural History Society of Northumberland, Durham, and Newcastle-upon-Tyne, vol. xi., part 1.                          | The Society.     |
| The Transactions and Annual Report of the Manchester Microscopical Society, 1891.                                                              | The Society.     |
| The Journal of the Northamptonshire Natural History Society, vol. iv., Nos. 30, 31, 32, vol. v., Nos. 33 to 40, vol. vi., Nos. 41 to 48.       | The Society.     |
| Catalogue of Type Fossils in the Cambridge Museum by H. Woods, B.A.                                                                            | The Council.     |
| The Proceedings of the Natural History Society of Kiew, vol. x., Nos. 3, 4, vol. xi., Nos. 1, 2.                                               | The Society.     |
| Annalen des K.K. Naturhistorischen Hofmuseums, Jahresbericht für 1891.                                                                         | The Society.     |
| Stavanger Museum, Aarsberetning for 1891.                                                                                                      | The Museum.      |
| Bergen Museum, Aarsberetning for 1890.                                                                                                         | The Museum.      |
| The Journal of the Liverpool Geological Association, vol. xi., 1890-91.                                                                        | The Association. |
| The Proceedings of the Bath Natural History and Antiquarian Field Club, vol. vii., No. 3.                                                      | The Club.        |
| The Transactions of the Yorkshire Naturalists' Union, part 17.                                                                                 | The Society.     |
| Extract from the Geological Magazine for Oct., 1892. The Liassic Sections near Bridport, by J. F. Walker, M.A., F.G.S.                         | The Author.      |
| Report and Proceedings of the Belfast Natural History and Philosophical Society for the Session 1890-91.                                       | The Society.     |
| The Bulletin of the Astronomical Society of Mexico for 1892, and Anuario del Observatorio Astronomico Nacional de Tacubaya, by Angel Anguiano. | The Society.     |

## BOOKS PRESENTED.

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| Atti della Reale Accademia dei Lincei,<br>vol. i., Nos. 1—5, 1891, vol. i., Nos.<br>1—12, 1892, vol. xi., Nos. 11, 12.      | } The Academy. |
| Brighton and Sussex Natural History<br>and Philosophical Society abstracts of<br>Papers and Annual Reports for 1891-<br>92. |                |
| The Annual Report of the Leeds Literary<br>and Philosophical Society 1891-92.                                               | } The Society. |
| Bollettino delle Pubblicazioni Italiane,<br>Nos. 144 to 162.                                                                |                |
|                                                                                                                             | } The Council. |
|                                                                                                                             |                |

## MUSEUM.

## GEOLOGICAL DEPARTMENT.

|                                                                                                    |                                                                 |
|----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|
| Horn and Part of Skull of Bison found<br>in cutting a drain at Tilts, near<br>Doncaster.           | } Philip B. Davies Cooke,<br>Esq., Gwysaney, Mold,<br>N. Wales. |
| Specimens of Fossil Wood, Jasper, Shells,<br>&c., from Antigua, collected by B.<br>Hague, Esq.     |                                                                 |
| A fossil Sponge from the Yorkshire<br>Chalk.                                                       | } Mr. P. Anderson,<br>Bridlington.                              |
| Specimens of <i>Terebratulina substriata</i> ,<br>from the Oolite, Suffield Heights.               |                                                                 |
| Specimens of <i>Thecidium ornatum</i> from<br>the Coral Rag, Ayton, Scarborough.                   | } J. F. Walker, M.A.                                            |
| Skull of Wolf, found at Hunt's Brewery,<br>Aldwark.                                                |                                                                 |
| A Fossil Tooth and Pecten from the<br>Stonesfield Slate.                                           | } J. E. Clark, B.A., B.Sc.                                      |
| Upwards of 50 specimens of Fossils from<br>the Rhœtic Beds of Aust Cliff, West<br>Gloucestershire. |                                                                 |
| The Elwes Collection of Tertiary Fossils.                                                          | } The late Wm. Reed.<br>F.G.S.                                  |
|                                                                                                    |                                                                 |

## ANTIQUITIES.

|                                                                                                                                             |                                               |
|---------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| Styca of Ethelred of Northumbria, two<br>threepennies of Charles II. and James<br>II. Silver penny of George II., and<br>small Danish Coin. | } C. Richardson, Esq.,<br>Field House, Whitby |
|                                                                                                                                             |                                               |

## DONORS.

- An Iron Sword with a bone handle, ornamented with enamel, of late Celtic work. } W. M. Bosville, Esq.,  
Two British Urns, one Cinerary, and } Thorpe near Bridlington.  
the other for food, the Cinerary urn }  
15 inches high; all found at Thorpe }  
Hall. }
- Three small British Urns found at } Thomas Boynton, Esq.,  
Woolsthorpe in Lincolnshire, one of } Bridlington Quay.  
them a drinking cup of rare beauty. }
- A large portion of a finely carved stone } Colonel Osbaldeston  
found at Filey. } Mitford, Hunmanby  
Hall. }
- A fine inscribed Roman Monument, and } H. Riley Smith, Esq.,  
part of another inscription, found } Tadcaster.  
under the Mount Hotel, York. }
- A Crusie or Scotch Lamp from the } Darcy Strangways,  
neighbourhood of Stornoway. } Esq., Alne Hall.
- A Carbine brought from Bunkers' Hill, } Dr. Brearey,  
Massachusetts, in 1775, by Capt. } Scarborough.  
Christopher Spencer Brearey. }

## ZOOLOGY AND COMPARATIVE ANATOMY.

- Recent Shells from the West Indies. } Mr. W. B. Lund,  
Petergate. }
- Merlin (Adult female) and young in half } J. Backhouse, Esq.  
down from the Teesdale Moors and }  
adult male from Spurn Point. }
- Two Hawfinches shot at Terrington.
- A specimen of the Box Fish, and recent } Mr. P. Anderson,  
Balanus. } Bridlington.

## MINERALOGY.

- A specimen of Labradorite, and speci- } Mr. C. Ladds.  
men of the Corsehill Stone from Arran, }  
Scotland. }
- A Rock specimen from the Mines of } Dr. Dunhill.  
Kimberley. }
- Rock specimens from Ticino and Grisons. Mrs. Fielden Thorpe.

## DONORS.

- A Rock specimen of Stonesfield Slate }  
 (shaped for a Roofing slate). } Mr. J. E. Clark, B.A.
- A specimen of Garnet Schist from the }  
 Grisons. } Mr. R. Thompson.
- A Rock specimen of Labradorite from }  
 Denmark, and specimen of Encrinite } Mr. C. Milburn.  
 Limestone from Bishop Auckland. }

## BOTANY.

- A specimen of the Fruit of the Sago } Mrs. Gutch,  
 Palm, grown at Leeds. } Holgate Lodge.
- A Collection of British Plants forming }  
 part of the Collections of the late Mr. }  
 Henry Baines, Dr. Spruce, the late } Mr. A. W. Walker.  
 J. Backhouse, and Henry Ibbotson. }
- A series of Hymalayan Ferns. Mrs. Williamson.

## SERIAL WORKS SUBSCRIBED FOR.

- Natural History of the Tineina, by H. T. Stanton, F.R.S.  
 Nautical Almanack.  
 Proceedings of the Zoological Society.  
 Publications of the Palæontographical Society.  
 „ „ Ray Society.  
 Sowerby's Thesaurus Conchyliorum.  
 Annals and Magazine of Natural History.  
 Geological Magazine.  
 Journal of the British Archæological Association.  
 Numismatic Chronicle.  
 Memoires de la Société Paléontologique Suisse.  
 D'Orbigny's Paléontologie Française.  
 Geological Record.  
 Nature.  
 Publications of the Surtees Society.  
 Hardwicke's "Science Gossip."  
 The Yorkshire Archæological Journal.

## RESOLUTIONS

PASSED AT THE ANNUAL MEETING HELD FEB. 7<sup>TH</sup>, 1893.

1. That the Report of the Council now read be adopted and printed for circulation amongst the Members, Lady Subscribers, and Associates of the Society.

2. That the thanks of the Society be given to the Members of the Council retiring from office, also to the Treasurer, Secretary, and Curators, for their valuable services; and that authority be given to the Council to give admission to the Public to the Museum on Whitsun-Monday and Tuesday, under the same regulations as last year.

3. That the thanks of the Meeting be given to the Chairman.

# NOTES ON YORK METEOROLOGY FOR 1892.

BY

J. EDMUND CLARK, B.A., B.Sc.

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## COLD AND HEAT IN APRIL, 1892.

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The barometer was high, the mean being  $30\cdot023$  against an average of  $29\cdot904$  for the fifty years, 1841-90, with which comparisons will here be made. Only on the 27th was there any serious fall ( $29\cdot455$ ). This resulted in the storm of cold rain ( $0\cdot63$ ). On the 14th, after the heavy snow-fall, which melted to  $0\cdot83$  of rain, the barometer fell to  $29\cdot68$ .

For the fourth month in succession there was more snow than rain,  $0\cdot96$  falling in this form out of a total of  $1\cdot86$ , as measured at Bootham School. It will be noted that of this total,  $1\cdot49$  fell on two out of the 12 "rainy" days. Thus far no warm rain-shower has fallen.

Only on five days was the wind from southern quarters.

Temperature, as shown by the mean of the maximum and minimum thermometers ( $44\cdot8^{\circ}$  for the month) was  $1\cdot1^{\circ}$  below the average. But this gives little idea of the anomalous nature of the month. The maxima average  $55\cdot2^{\circ}$ , the minima  $34\cdot4^{\circ}$ . The former is  $1\cdot6^{\circ}$  in excess; the latter  $3\cdot6^{\circ}$  deficient. The latter record was only surpassed in 1842, just fifty years ago, when the maximum ( $55\cdot7^{\circ}$ ) was even higher. But the range of nearly  $21^{\circ}$  is extraordinary.

It is, however, surpassed by the daily records. Frosts occurred on no less than 22 nights, snow falling on 7 days.

On the 16th,  $24^{\circ}$  was recorded and  $20^{\circ}$  on the grass. This was surpassed only last year ( $22^{\circ}$ ); in 1881, when  $22\cdot4$  was recorded, and in 1842 when the minimum was  $23^{\circ}$ . On the 14th, also,  $25^{\circ}$  was touched; besides the above, this has been thrice equalled, but not surpassed. In 1864-5-6, 1870 & 1872, there was no frost registered in the screen.

The warmest day was the 21st (mean of 8 a.m. and p.m.  $53^{\circ}$ ); until then, indeed, the hottest days were January 30th ( $49^{\circ}$ ), and March 17th and April 5th, with means of  $50^{\circ}$ . The 22nd,

also, just exceeded  $50^{\circ}$ . Still on no day did the mean of maxima and minima reach  $50^{\circ}$ : this has only occurred on March 18th. And yet some of the maxima during the opening week were extraordinary, the  $71.3$  of the 1st not having been equalled at so early a date, whilst nothing above  $70^{\circ}$  has been recorded since 1875. The other records above  $70^{\circ}$  are in 1852 ( $72^{\circ}$ ), 1859 ( $73^{\circ}$ ), 1864 ( $71\frac{1}{2}^{\circ}$ ), 1869 ( $76^{\circ}$ ), 1870 ( $75^{\circ}$ ), and 1874 ( $75^{\circ}$ ). In many years  $70^{\circ}$  is not reached before June.  $67.6^{\circ}$  (in 1884) is the highest March record before this year.

As the minimum on April 1st was  $27^{\circ}$  ( $22^{\circ}$  on the grass) there was a range of  $44^{\circ}$ , which has probably been rarely equalled. The cause was the almost entire absence of wind, the intensely dry air and the clear skies. At mid-day differences between the wet and dry bulb of  $14^{\circ}$  to  $16^{\circ}$  were recorded at about this date, which gives a relative humidity of under 35 per cent.

After the 12th the horizon was unusually clear, so that the West Riding Hills were visible from Feversham Terrace on 12 days, which is the highest record during the 10 years of these observations.

Solar Halos were observed 10 times, lunar halos twice, mock suns three times. The halo and mock suns on the 30th were of extraordinary brilliancy and endurance, whilst on the night of May 1st the very rare phenomenon of a mock moon was noted, at the same time as an Aurora (10-45 - 11 p.m.). The Aurora on the 25th was very fine, perhaps the finest witnessed here since 1882. Streamers, although intermittent, were bright and extensive, and the crimson shades above Venus at times very intense. The maximum effect was at 9-45 p.m., but it was still visible after 12.

Bright sunshine reached the unusual April total of 179 hours, only exceeded during the previous eleven years of observations by the 182 hours of 1887. These values are both 50 per cent. above the average. In 1885 we had only 87 hours.

## THE RAINS AND FLOODS.

OCTOBER 14—17, 1892.

From October 12th to 19th an area of low pressure pursued a most extraordinary and apparently unprecedented course to the south of our Islands. Appearing off the Bay of Biscay, it passed due E. to near the Puy de Dôme by the 13th; N.E. to Orleans by the evening; to the Channel Isles on the morning of the 14th; Falmouth by that evening; S.W. into the Atlantic by the 15th; E. into the Bay of Biscay again, but further north that evening; to the mouth of the Loire, 16th; Geneva 17th; and, skirting the Alps, into the Gulf of Genoa on the 18th, it passed off towards Leghorn on the 19th. In this neighbourhood it lingered, and by the 22nd had increased in intensity, doubtless causing the great floods which followed in Corsica.

Meanwhile the barometer was also low over Scandinavia, a depression over Copenhagen on the 13th, working its way up the East coast of the Baltic. On the 14th it split. Part had its centre at Hammerfest and then passed eastwards along the North coast of Russia. Part passed towards Moscow. A wedge of high pressure forced its way between the two main areas of low pressure, but fell back on the 15th. This kept the barometer steadily high at York, with Easterly winds, a condition which usually accompanies our most prolonged rainfalls.

The main depression caused a deluge in Southern France, the totals at Nice being 1·90 on the 13th and 2·56 on the 14th.

Our rainfall, which with an unbroken duration of 42 hours from midnight on the 13th—14th produced 2·61 inches,\* was for York the most prolonged within my recollection. Possibly the rainfall, which in August broke up the great drought of 1868 was more prolonged in South Western England. At Ackworth, however, it lasted fifty hours, the total being 3·59

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\* This includes a few showers on the 12th. The amounts vary as usual, but as the table shows not so greatly as sometimes.

inches and 4·6 (7 p.m. 13th to 5 p.m. 15th) at Aysgarth. At Bradford 4·67 inches fell in the 39 hours between 4·30 a.m. on the 14th and 7·30 p.m. on the 15th; at Dalton, at Huddersfield 4·89 in 48 hours; at Malton, 2·93 in 36 hours. At Aysgarth and Upper Nidderdale returns exceeding 5 inches are given. The accompanying table shows the distribution over the county, so far as records are to hand. I beg to acknowledge the kindness of those who have sent these valuable returns. The rainfall on the days preceding and following was everywhere but trifling.

The East Coast was affected almost throughout, Yarmouth reporting an inch for the 14th; Spurn Head 0·93 inch, and 1·68 inches in all.

The recording thermometer, from 8 a.m. on the 14th to 2 p.m. on the 16th, varied only from 52° at 2 p.m. on the 14th to 50° at 4 a.m. next morning.

| REGION.            | STATION.                                  | 13th | 14th | 15th | Totl | OBSERVER.            |
|--------------------|-------------------------------------------|------|------|------|------|----------------------|
| Tees .....         | Barnard Castle, Whorlton .....            | 0·25 | 1·53 | 0·24 | 1·82 | per J. G. Symons.    |
| Tees .....         | Mickleton .....                           | 0·12 | 1·58 | 0·18 | 1·83 | „                    |
| Esk .....          | Guisborough .....                         | 0·60 | 1·40 | 0·48 | 2 48 | „                    |
| Swaledale ..       | Brigflatts, W. of Sedburgh .....          | 0·23 | 1·02 | 0·00 | 1·25 | J. Handley.          |
|                    | Hawes Junction .....                      | 0·40 | 2·35 | 0·16 | 2·91 | W. H. Binnie.        |
|                    | Hawes, Hardrow Vicarage .....             | 1·41 | 3·47 | 0·60 | 5·48 | Rev. F. W. Stow.     |
|                    | Aysgarth .....                            | 1·12 | 3·36 | 1·02 | 5·50 | per J. G. Symons.    |
|                    | Masham .....                              | 0·42 | 2·08 | 0·59 | 3·09 | J. A. Greenwood.     |
|                    | Ripon, Mickley .....                      | 0·34 | 2·12 | 0·55 | 3·01 | per J. G. Symons.    |
|                    | West Houses, Angram (1,150 feet) .....    | 0·60 | 4·50 | 1·23 | 6·33 | per J. Priestman.    |
| Nidderdale ..      | High Riggs (1,010 feet) .....             | 0·50 | 4·45 | 0·84 | 5·79 | „                    |
|                    | New Houses (755 feet) .....               | 1·20 | 4·63 | 1·02 | 6·85 | „                    |
|                    | Raygill House (925 feet) .....            | 0·82 | 3·90 | 1·04 | 5·76 | „                    |
|                    | Ramsgill (450 feet) .....                 | 1·00 | 4·03 | 0·72 | 5·75 | „                    |
|                    | Pateley Bridge, Castlestead .....         | 0·85 | 3·25 | 0·86 | 4·96 | per J. G. Symons.    |
|                    | Knaresborough .....                       | 0·50 | 2·05 | 0·58 | 3·13 | G. Paul.             |
|                    | Ribston, near Knaresborough .....         | 0·82 | 1·64 | 0·65 | 3·11 | J. Dent Dent.        |
| Ouse .....         | Thirsk .....                              | 0·50 | 1·40 | 0·30 | 2·20 | C. M. Swarbreck.     |
|                    | E. Layton (Darlington) .....              | 0·23 | 1·63 | 0·46 | 2·32 | per J. G. Symons.    |
|                    | Melmerby (Baldersby) .....                |      | 1·25 | 0·30 | 1·55 | „                    |
|                    | York, Bootham School .....                | 0·41 | 1·73 | 0·46 | 2·60 | J. E. Clark.         |
|                    | York, Philosophical Society Grounds ..... | 0·38 | 1·73 | 0·50 | 2·61 | Met. Office Gauge.   |
|                    | York, Cherry Hill .....                   | 0·42 | 1·66 | 0·46 | 2·54 | H. Richardson.       |
|                    | York, Mount School .....                  | 0·41 | 1·70 | 0·57 | 2 68 | Miss H. Bayes.       |
| Wharfedale ..      | York, Mount Villas .....                  | 0·30 | 1·61 | 0·57 | 2·45 | John S. Rowntree.    |
|                    | Oughtershaw Hall (Wharfe) .....           | 1·08 | 3·26 | 0·47 | 4·81 | per J. G. Symons.    |
|                    | Arncliffe Vicarage (Wharfe) .....         | 0·70 | 2·59 | 0·44 | 3·73 | „                    |
|                    | Ilkley .....                              | 0·54 | 2·30 | 0·66 | 3·50 | H. Richardson.       |
|                    | Bradford (20, Merton Road) .....          | 0·36 | 3·43 | 0·88 | 4·67 | Albert Wilson.       |
|                    | Bradford (Exchange, about 366 feet) ..... |      | 2·72 |      |      | J. Priestman.        |
|                    | Bradford .....                            | 0·42 | 2·81 | 0·57 | 3·80 | H. Harris.           |
| Aire and Calder .. | Leeds, Cliff Lodge .....                  | 0·68 | 2·52 | 0·64 | 3·84 | R. Reynolds.         |
|                    | Leeds, Museum .....                       | 0·91 | 2·84 | 0·58 | 4·33 | E. R. Waite.         |
|                    | Leeds, Water Works .....                  | 0 94 | 3·53 | 0 91 | 5·38 | G. Wood.             |
|                    | Dalton, Huddersfield .....                | 0·84 | 3·01 | 1·04 | 4·89 | J. W. Robson.        |
|                    | Slaithwaite (Blackmoorfoot) .....         | 0·54 | 2·48 | 1·00 | 4·02 | per J. G. Symons.    |
|                    | Wakefield (Alverthorpe Hall) .....        | 0·88 | 3·50 | 0·86 | 5·24 | Miss L. Clarkson.    |
|                    | Wakefield (Prison) .....                  | 0·92 | 2·38 | 0·84 | 4·14 | per J. G. Symons.    |
| Went. ....         | Ackworth, Flounders Coll. ....            | 0·70 | 2·13 | 0·76 | 3·59 | J. J. Garnett.       |
|                    | Ackworth, School .....                    |      | 2·20 |      |      |                      |
| Don .....          | Doncaster, Magdalen's .....               | 0·75 | 1·39 | 0·69 | 2·83 | per J. G. Symons.    |
|                    | Market Weighton .....                     | 4·15 | 4·15 |      |      | Canon Wells.         |
|                    | Market Weighton, Houghton .....           | 1·05 | 1·55 | 1·50 | 4·10 | per J. G. Symons.    |
| Wolds .....        | Malton, Old .....                         | 2·93 | 5 pm | 13th | 2·93 | H. Hurtley.          |
|                    | Malton, Norton .....                      | 2·87 | 5 pm | 13th | 2·87 | „                    |
|                    | Malton .....                              |      | 1·80 |      |      | Yorks. Herald, 17th. |
| Coast .....        | Driffeld .....                            | 0·61 | 2·40 | 0·54 | 3·55 | J. Lovel.            |
|                    | Bridlington .....                         | 2·10 | 2·10 | 0·34 | 2·44 | J. Broomhead.        |
|                    | Scarboro' .....                           | 0·49 | 1·54 | 0·57 | 2·50 | H. G. H. Monk.       |
|                    | Scarboro', South Cliff .....              | 0·47 | 2·46 | 0·84 | 3·77 | F. T. Walker.        |
|                    | Spurn Head .....                          | 0·25 | 0·93 | 0·50 | 1·68 | Met. Office Gauge.   |
|                    | Hull, Pearson Point .....                 | 0·55 | 1·85 | 0·57 | 2·97 | per J. G. Symons.    |
|                    | Brigg .....                               | 1·12 | 1·15 | 0·79 | 3·06 | per J. G. Symons.    |
| Lincoln ....       | Hornecastle, Hemingby .....               | 0·85 | 0·85 | 0·94 | 2·64 | „                    |
|                    | Shields .....                             | 0·02 | 0·29 | 0·02 | 0·33 | Met. Office Gauge.   |
|                    | Liverpool .....                           | 0·12 | 0·48 | 0·57 | 1·17 | „                    |
|                    | Loughboro' .....                          | 0·43 |      | 0·34 |      | „                    |

The last five stations indicate the character of the fall in the surrounding counties. The heaviest falls appear to have been in the lower sections of the West Riding Dales. The series from Brigflatts over the Pennines to Hawes Junction, and down the Yore, is especially noteworthy. The rain would appear to have begun and ceased earliest to the west. The latter of course is natural with an easterly rain, as well as that the heaviest falls are away from the valley heads; but it is very interesting to find that it began, apparently, also to the west.

The *universality* of the rainfall is very different from the ordinary heavy falls. These are usually the result of local thunderstorms. Thus, since 1875, the heaviest fall was of 2·28 inches on July 25th, 1886. Another fall exceeding the present of 1·73 inches was that of 1·90 inches on September 28th, 1871.

The exceptional nature of such wide-spread heavy rain is evident from the fact that we must go back to October, 1689, for any great flood not in the winter months, and therefore, presumably, not due to melting snow.

As a rule the present flood exceeded everywhere those of recent years. Accidental circumstances sometimes caused exceptions. Thus at Pateley Bridge the destruction of a wall greatly relieved the town, and at Leeds the Aire rose higher in 1866, when the rainfall was less, because "of the old stone bridge, which then materially obstructed the river" (R. Reynolds, Esq.) Bradford drainage prevented any special flood there, whilst "at Shipley, two miles away in the Aire valley, they had one of the highest floods ever remembered" (John Priestman, Esq.).

The Ouse, though above 10 feet in the morning, did not rise much more until Saturday afternoon. Only late in the evening was alarm felt, and many, whose houses were flooded, first found it out by coming down into the waters on Sunday morning. Before that time it had practically reached its highest point, although, probably because of the tides, it rose a little higher in the afternoon after a slight ebb.

Levels taken by me on the 26th, when the river stood at 1ft. 6in. on the Ouse Bridge gauge, indicate that the high-water line, marked in soot, &c., on the Hospitium, was 16 feet

0 inches \* above summer level. Heights were also noted on the railings at the foot of the steps on the upper side of Lendal Bridge, by the Waterworks offices. These, on the 26th, were found to give a fraction of an inch over 15ft. 10in. above the same gauge-level. This mark was 22 inches higher than the mark I recorded at the same spot in the flood of March 10th, 1881; and at the Ouse Bridge gauge the height is reported to have been 15ft. 8in., with which my observations agreed.

These slight differences may be merely due to errors, but they are very probably real, and mark the fall of level in going down stream during high flood. Since writing thus far I have obtained from Mr. Creer, our efficient City Surveyor, a valuable series of levels, taken from ordnance datum. We thus get the following table, based upon the fact that the "summer level" of the Ouse bridge gauge is 16·75 ft. or 16 ft. 9 in. above adopted sea-level.

| LOCALITY.                                                                   | Height<br>above<br>Ordnance<br>datum<br>level. |  | Height of<br>flood<br>above Ouse<br>summer level. |    |
|-----------------------------------------------------------------------------|------------------------------------------------|--|---------------------------------------------------|----|
|                                                                             | Ft.                                            |  | Ft. In.                                           |    |
| Salisbury Terrace, Leeman Road ... ..                                       |                                                |  | 16                                                | 9  |
| Scarbro' Railway Bridge ... ..                                              |                                                |  | 16                                                | 3  |
| Marygate Estate at Hetherton Street ... ..                                  | 32·93                                          |  | 16                                                | 2  |
| Hospitium ... ..                                                            | 32·79†                                         |  | 16                                                | 0½ |
| Waterworks Offices, Lendal Bridge... ..                                     |                                                |  | 15                                                | 11 |
| Lendal Bridge, by Waterworks Offices ... ..                                 |                                                |  | 15                                                | 10 |
| Lendal Bridge, by Rowntrees' Cocoa Works ... ..                             | 32·56                                          |  | 15                                                | 10 |
| Municipal Offices, basement ... ..                                          |                                                |  | 15                                                | 11 |
| Wellington Row ... ..                                                       |                                                |  | 15                                                | 10 |
| Ouse Bridge Inn [corrected from 15ft. 10in.,<br>as gauge set 2 in. too low] |                                                |  | 15                                                | 8  |
| North Street, near Castle Inn ... ..                                        | 32·43                                          |  | 15                                                | 8  |
| Mr. J. Mills' mills, Skeldergate ... ..                                     | 32·29                                          |  | 15                                                | 6  |
| Castle Wall, Tower Street ... ..                                            | 31·96                                          |  | 15                                                | 3  |
| Skeldergate Bridge, Upper Side ... ..                                       |                                                |  | 15                                                | 1  |
| Castle Mills Bridge Lock ... ..                                             | 31·21                                          |  | 14                                                | 5  |
| Fishergate, near Castle Mills Bridge... ..                                  |                                                |  | 14                                                | 6  |
| Blue Bridge Lane ... ..                                                     |                                                |  | 14                                                | 5  |
| New Walk End ... ..                                                         |                                                |  | 14                                                | 3  |
| Love Lane, Fulford ... ..                                                   |                                                |  | 14                                                | 1  |
| Pallister's Yard, Walmgate ... ..                                           | 31·41                                          |  | 14                                                | 8  |
| Foss Islands Road ... ..                                                    |                                                |  | 15                                                | 7  |
| Fossgate, Merchants' Hall ... ..                                            |                                                |  | 14                                                | 6  |

\* Corrected for error of Ouse Bridge gauge, set 2 inches below ordnance datum for summer level, 16ft. 9in.

† Since this was in proof, Mr. Creer has taken independent levels, which agree within less than half an inch of my own results.

In 1881, I found a difference of 6 inches between the lower side of Ouse Bridge and the upper side of Lendal Bridge, although the flood was not so high. The approaches to Skeldergate Bridge were then complete. Probably the coffer-dam and other obstructions insepararable from the present drainage works caused the slight difference. The Ouse appears to have been at least 11 inches lower than in 1831. The Foss, as shown by the record made by the chapel under the Merchants' Hall, was  $13\frac{1}{2}$  inches lower. At Naburn Locks it was 11 inches lower. The height at Castle Mills Bridge, 1ft. 2in. lower than at Ouse Bridge, is rather unexpected. The flood coming down the Foss must have been decidedly less than in 1831, and the effect of Skeldergate Bridge and the coffer-dam just below it, upon the Ouse, must have been considerable. This point will be further considered later on.

It is matter of regret that no systematic hourly observations were undertaken, as such might prove of great value for future forewarnings. A few, however, have been kindly supplied to us by B. Seebohm Rowntree, Esq., taken at the Cocoa Works. These are reduced to the levels, as given by the Lendal gauge, hard by. A few records are added from the City Surveyor's report.

HEIGHTS AT LENDAL BRIDGE (9 a.m. and 5 p.m.) AND ADDITIONS FROM  
COCOA WORKS

|              |           | Ft. | In.             |
|--------------|-----------|-----|-----------------|
| October 14th | 9 a.m.    | 0   | 6               |
|              | 5 p.m.    | 2   | 3               |
| 15th.        | 7 a.m.    | 10  | 1               |
|              | 8 a.m.    | 10  | $3\frac{1}{2}$  |
|              | 9 a.m.    | 10  | 6               |
|              | 10 a.m.   | 10  | 8               |
|              | 11 a.m.   | 10  | $10\frac{1}{2}$ |
|              | 12 noon.  | 11  | 0               |
|              | 6 p.m.    | 13  | 4               |
| 16th.        | 8 p.m.    | 14  | 4               |
|              | 3 a.m.    | 15  | 4               |
|              | 3-25 a.m. | 15  | 10              |

The latter portion of this table is based upon the statement that from 11 a.m. to 6 p.m. the rise was about 4 inches per hour; from 6 p.m. to 8 p.m. about 6 inches per hour. From 3 a.m. (16th) to 3-25 the *measured* rise was 6 inches, and there was practically no further rise. These values give, however, a very slow rate from 8 p.m. to 3 a.m., so that, possibly, the word "about" must be taken to indicate an extreme value from 11 a.m. to 3 p.m.

The flood subsided slowly, as is shown by the following figures for the Ouse Bridge gauge:—

|               |            | Ft. | In. |
|---------------|------------|-----|-----|
| October 16th. | 3 p.m.     | 15  | 8   |
| 17th          | 8 a.m.     | 14  | 5   |
| 18th.         | 8 a.m.     | 12  | 0   |
| 18th.         | 3 p.m.     | 11  | 8   |
| 19th.         | 8 a.m.     | 9   | 6   |
| 19th.         | 10-30 a.m. | 9   | 8   |
| 20th.         | 3 p.m.     | 4   | 9   |
| 22nd.         | 12-30 p.m. | 3   | 8   |
| 23rd.         | Noon.      | 2   | 4   |
| 25th.         | Noon.      | 1   | 4   |

On the 28th it rose again to 7ft. 10in. The 8 a.m. records are from the table.

The total rainfall for October, 4·94, exceeded that of any year since 1840 except that of 1870 (6·10). In 1882 4·84 inches fell. Three falls in October exceeding an inch have occurred since 1874, namely 1875, 1·20 in.; 1876, 1·09 in., and 1880, 1·50 in.

Eleven years ago, in a letter to the *York Herald*, preceding the great flood of March 10th, 1881, I wrote:—"The American Weather Office issues warnings of floods in their great river systems. Could not a little be done in the Ouse basin in this line? A little experience would suffice to tell if a given amount of rise at Knaresbro', Ripon, &c., would produce dangerous floods at York. By aid of the telegraph the city could have several hours of valuable warning, a space of time which could be lengthened to nearly half-a-day for Selby, and parts lower down."

Nothing, of course, has been done; but we may note that not a few business firms in York would now have saved hundreds of pounds, had they from that time on had a system of private telegrams from, say, Pateley Bridge, Knaresbro', Ripon, Aysgarth, and Richmond, warning them of any dangerous rise of the waters. But this is not a matter for private enterprize; it would form most fitting work for our County and City Councils. Under their orders telegrams at frequent intervals should be sent to some central station, whenever the rivers rose as much, say, as five feet above summer level. It would require but a little experience for the Central Office to gauge the probable result right down the

Ouse valley, both as to the time and height. Such warnings might have easily been given in York by noon on Saturday, the 15th. Public and private losses in York alone to the amount of thousands of pounds could have been avoided, and we might not have to mourn the irreparable injuries to our city archives.

But it is not only in the cities; damage to stock and crops might often be lessened with rather greater warning. We may ask, also, whether the damage done to the North Eastern Railway would have been so serious, had the officials had more warning. The appalling accident at Thirsk in November was directly due to the lack of reserve signalmen, so many being on duty because of damages done by the flood.

Some reference has already been made to previous floods. There have been so many changes in the "summer level" of the river, and probably also, so much inaccuracy of ancient records, that the actual relation of one flood to another can rarely be relied on, unless some permanent record has been clearly made.

Such records exist, or have existed until lately, for the floods of 1625, 1636, 1763, 1795, 1809, 1831, for the Ouse; and 1831 for the Foss.

It is greatly to be regretted that no contemporary record for the Ouse now exists for 1831 at York. Mr. Reader made such a record at Naburn, which was 11 inches above the level of the late flood, and 19 above that of 1869, when the hunting accident on the Nidd occurred. No flood since 1831 had entered his front door until this present year.

Metal gauges should surely be set at good localities, upon which future records could be engraved.

Few situations would be more suitable than upon the wall of the Hospitium. Perhaps our council would undertake this.\*

The various causes effecting a change in the Ouse level, at York, so far as I have found, are as follows:—

1754 Dam built; Archbishop's lawyer writes in alarm as to effects at Bishopthorpe.

1755 Locks completed; probably in October.

1757 Extra sluices completed.

\* This is being done.

- 1835  $1\frac{1}{2}$  foot board placed above the Weir. Improved sluices.
- 1843-4 The construction of the present Scarbro' Railway Bridge and approaches.
- 1845 The construction of the present Ouse Bridge probably facilitated the flow.
- 1876 Boards increased to 1ft. 10in.
- 1879-81 The construction of the Skeldergate Bridge and approaches.
- 1881 & 83 Six shutters of 264 square feet total area, replace the six sluices of '35, with an area of 102 square feet.

The table herewith appended gives the height of floods as recorded, and where possible, the height as corrected to their probable level at Ouse Bridge by the present flood, taking that as registering 15ft. 8in. at the Ouse Bridge gauge. The two best comparisons are for the floods of 1636 and 1763. The present gauge registers from 16.75 ft. above ordnance datum.

| MR.<br>CREEER'S<br>RESULTS. | DATE.              | HEIGHT<br>AS<br>GIVEN.  | HEIGHT<br>AS COR-<br>RECTED<br>TO<br>PRESENT<br>GAUGE. | REMARKS AND AUTHORITY.                                                                                                                                                            |
|-----------------------------|--------------------|-------------------------|--------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                             |                    | Ft. In.                 | Ft. In.                                                |                                                                                                                                                                                   |
|                             | 1263 (Snow) ..     | 18 0                    | 18 3                                                   | D. Flooded across from North St. to Skeldergate, p. 281. "Highest known."                                                                                                         |
|                             | 1564 . . . . .     |                         | 18 0?                                                  | N. Two arches of Ouse Bridge washed away.                                                                                                                                         |
|                             | 1614, March        |                         | 18 0?                                                  | D. North St. flooded for 10 days. Frost and Snow. Jan. 16—Mar. 10. "Highest ever remembered."                                                                                     |
|                             | 1625, Feb. . .     | 18 8                    | 18 3                                                   | L. and date on City walls, St. George's Field.                                                                                                                                    |
|                             | 1636 . . . . .     | 18 0                    | 17 6                                                   | Line and date on City walls, St. George's Field.                                                                                                                                  |
|                             | 1689, Oct. . .     | 16 9                    | 18 3                                                   | L., &c. 8 or 10 inches higher than 1636: as high as 1263.                                                                                                                         |
| 16 3                        | 1732, Jan. . . . . | 17 10                   | 17 4                                                   | D. Eleven inches below 1689.                                                                                                                                                      |
|                             | 1763, Dec. . . . . | 17 5½                   | 16 2½                                                  | L. "York Antiquities, 1785, says: 'higher than ever known by 8 inches.'" But have the brass plate at Ouse Bridge Inn.                                                             |
|                             | 1783, Feb. . .     | 15 11                   | ..                                                     | N.                                                                                                                                                                                |
|                             | 1795 . . . . .     | 18 0                    | 16 4                                                   | M.T. Corrected by recent floods.                                                                                                                                                  |
|                             | 1809 . . . . .     | 17 4                    | 15 10                                                  | L., M.T. (Not in Mr. Leetham's list.)                                                                                                                                             |
|                             | 1824, Oct. . . . . | 14 7                    | ..                                                     | Mr. Leetham's list (see note.)                                                                                                                                                    |
|                             | 1824, Dec. . . . . | 14 7                    | ..                                                     | L.                                                                                                                                                                                |
| 17 1                        | 1831, Feb. 10      | 18 6 )<br>17 2 )<br>&c. | 16 8                                                   | L., M.T., &c.                                                                                                                                                                     |
|                             | 1837, Jan. . . . . | 13 0                    | ..                                                     | L.                                                                                                                                                                                |
|                             | Dec. . . . .       | 14 0                    | ..                                                     | L.                                                                                                                                                                                |
|                             | 1839, Sept. . .    | 13 0                    | ..                                                     | L.                                                                                                                                                                                |
|                             | 1840, Jan. . . . . | 14 0                    | ..                                                     | L.                                                                                                                                                                                |
|                             | 1841, Jan. . . . . | 14 0                    | ..                                                     | L.                                                                                                                                                                                |
|                             | 1852, Oct. . . . . | 12 0                    | ..                                                     | L.                                                                                                                                                                                |
|                             | 1854, Jan. . . . . | 13 9                    | ..                                                     | L.                                                                                                                                                                                |
|                             | 1855, Oct. . . . . | 12 5                    | ..                                                     | L.                                                                                                                                                                                |
|                             | 1856, Jan. . . . . | 12 6                    | ..                                                     | L.                                                                                                                                                                                |
|                             | Sept. . . . .      | 13 4                    | ..                                                     | L.                                                                                                                                                                                |
|                             | Oct. . . . .       | 15 6                    | 15 0                                                   | L. Was at least 8 inches lower at Naburn than in 1892. Castlegate was flooded. But highest from 1831—'92 at York.                                                                 |
|                             | 1866 . . . . .     | ..                      | ..                                                     | L.                                                                                                                                                                                |
|                             | 1868, Feb. . . . . | 16 0†                   | 13 0                                                   | L.                                                                                                                                                                                |
|                             | 1869, Feb. 5 . .   | 16 4                    | 14 10?                                                 | L. Mr. Reader, at Naburn: 8 inches lower there than in 1892. The Nidd accident.                                                                                                   |
|                             | Dec. . . . .       | 15 6†                   | 12 6                                                   | L.                                                                                                                                                                                |
|                             | 1870, Jan. . . . . | 14 0                    | 13 10                                                  | L. Rose just upon tessellated pavement in Hospitium. (Canon Raine.)<br>In this flood we boated <i>over the hedge</i> in one case, along the foot-path to the waterworks. (J.E.C.) |
|                             | " " . . . . .      | 13 0                    | 13 0                                                   | L.                                                                                                                                                                                |
|                             | 1875, Jan. 15 . .  | 12 6                    | 12 6                                                   | L.                                                                                                                                                                                |
|                             | 1877, Jan. 1 . .   | 13 0                    | 13 0                                                   | N.                                                                                                                                                                                |
|                             | 1877, March . .    | 12 9                    | ..                                                     | L.                                                                                                                                                                                |
|                             | 1878, Oct. . . . . | 12 6                    | 12 6                                                   | T.C.                                                                                                                                                                              |
|                             | 1880, Nov. 15      | 12 6                    | 12 6                                                   | T.C.                                                                                                                                                                              |
|                             | " Dec. 15          | 12 6                    | 12 6                                                   | T.C. In the first week.                                                                                                                                                           |
|                             | " Dec. 24          | 12 0                    | 12 0                                                   | T.C.                                                                                                                                                                              |
|                             | 1881, Mar. 10      | 13 11                   | 13 9                                                   | { J.E.C. Reduced by 2 inches to correspond with the correction of the Ouse Bridge gauge given by Mr. Creer in his November Report (1892), Ouse Navigation Committee.              |
|                             | 1892, Oct. 16      | 15 10                   | 15 8                                                   |                                                                                                                                                                                   |

REFERENCE LETTERS. D—Drake's Eboracum; N—Newspaper Cuttings; L—Mr. Leetham's List (earlier from Drake, &c.); M.T.—Record at Marygate Tanyard; T.C.—Town Clerk's Records.

† Probably an error of 3 feet in the records. A break, apparently, from 1856 to 1866. The original of these returns (marked T.C.) is now in the hands of Mr. T. Humphries, 15, High Ousegate, who received them from Mr. Leetham, by whom the earlier entries were collected, and the later recorded up to 1875.

ADDITIONAL NOTES :—1625. The record for this and the next flood can be seen on the Friar's Wall, the first buttress from Tower Street. These two marks read 17 feet 10 inches and 17 feet  $1\frac{1}{2}$  inches above the present "summer level" of 16 feet 9 inches. Taking the difference of the *present* flood (5 inches) between here and Ouse Bridge the heights would be 18 feet 3 inches and 17 feet  $6\frac{1}{2}$  inches respectively. But Skeldergate Bridge, its approaches, and the Coffor Dams must certainly have pounded back the water at Friar's Wall, so that probably most of the difference (9 inches) between the latter and Castle Mills Locks should be added at well. This makes the probable height of the two floods at least equal to the usually accepted values.

1689. This value is probably two feet too low, since careful comparisons are made with that of 1636.

1831. The mark for this at Marygate Tanyard stood 4 inches above the flood of 1795 and 14 inches above that of 1809. Frequenters of Ouse Bridge Inn report it to have been some two inches lower than the mark there of 1763; but this can hardly be correct. Several old inhabitants were able to give pretty precise information. *Mr. W. Monkhouse* informed me that they could not get into the cross-lane from the foot of Marygate to S. Mary's. This means 9 inches higher *at least*, although alterations have been made. *Mr. Fletcher*, Joiner, &c., Coppergate, then lived, a boy of 12, at 5, Providence Place, near Rowntree's Cocoa Works. The water then just entered the oven. This time it was 11 inches *below*. Hence the height was at least a *foot* more in 1831 than 1892. *Mr. Creer* obtained a record from Tower Street which indicated a difference of 14 inches there, and himself adopts 17 feet 1 inch as the height of this flood. Hence it seems safe to accept the 1831 flood as 1 foot, almost exactly, higher than that of 1892. The *Foss*, as shown by the record outside the Merchants' Hall Chapel door, rose  $13\frac{1}{2}$  inches higher in 1831. *Mr. Reader*, Ferryman at Naburn, placed a brass plate on his door in 1831. The flood there, in 1892, reached within 11 inches of this. No flood in the interval touched the door; *i.e.* none rose within 8 inches of 1892. It *just* reached this level at the "Slingsby" flood, 1869.

Mr. Alfred Creer's excellent notes on the flood in his quarterly report of the Ouse Navigation Committee (November, 1892) should be consulted in connexion with these notes.

In conclusion, may we not hope for two results from the recent visitation? First, suitable gauges, and an automatic recorder, the one to record the extremes, the other all the fluctuations above and below summer level, with which the health of the city is so intimately connected. Secondly, a systematic series of warnings, the cost of which would be but the merest fraction of what would have been saved by them in the present flood alone.

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## On the Brachiopoda recently discovered in the Yorkshire Oolites.

By JOHN FRANCIS WALKER, M.A., F.G.S.

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Since my former communication to this Society in the Report for 1889, I have been able to add to the list of Yorkshire Brachiopoda, *Thecidium ornatum*, Moore, and a variety of *Terebratulina substriata*, Schlotheim; a short account of these discoveries appeared in the Geological Magazine for 1892. I now give further notes on these species and references to their chief literature.

### **Thecidea ornata**, Moore.

*Thecidium ornatum*—Moore, 1861.

The Geologist, vol. iv., page 96, plate ii.,  
figure 1—3.

*Thecidium ornatum*—Davidson, 1876.

Suppl. to Jurassic Brachiopoda, page  
104, plate xiii., fig 5—9.

*Thecidium ornatum*—J. F. Walker, 1892.

Geological Magazine, page 548.

As this genus was named *Thecidea* by DeFrance, and this name is used by the continental Geologists, I think it advisable to use it for the sake of uniformity instead of *Thecidium*, a name afterwards given to it by Sowerby.

*Thecidea ornata* is so well described by Davidson in the supplement to his monograph on Jurassic Brachiopoda, that it is unnecessary here to do more than refer to that publication.

I have obtained a considerable number of specimens of *Thecidea ornata*, Moore, from the Coral rag in the bed containing *Phasianella*, (*Pseudomelania*) *striata*, *Pseudodiadema versipora*, *Hemicidaris intermedia*. They are from a quarry between Ayton and Scarbro', where they are very plentiful, especially the dorsal valve; but it is troublesome to find on account of its small size; it is best obtained by washing the marl and then carefully sifting it; occasionally it is found attached to *Ostrea*. Since I sent an account of this discovery to the Geological Magazine, I have been able to obtain specimens of this shell from some marl of a

similar horizon, at the railway cutting near Settrington, they were kindly obtained for me by S. Chadwick, F.G.S. My friend the late Mr. Charles Moore, F.G.S., gave me some specimens of this Brachiopod from his original locality, the coral rag of Lyneham, Wiltshire, with which the Yorkshire *Thecidea* perfectly agrees in form.

***Terebratulina substriata*, Schlotheim, sp.**

*Terebratulites substriatus*—Schlotheim, 1820.

Die Petrefacten-kunde, page 283.

*Terebratula striatula* (non Sowerby)—Zieten, 1830.

Die Versteinerungen Württem-  
burgs, page 59, plate 44, fig 2.

*Terebratula substriata*—von. Buch, 1838.

Essai d'une classification, et d'une  
description des Terebratules, Soc.  
Géol. de France, Tome 3, page 163,  
plate xvi., fig. 6.

*Terebratella substriata*—d'Orbigny, 1850.

Prodrome I., page 377.

*Terebratulina substriata*—Davidson, 1852.

Annals and Mag. Nat. Hist., page  
255; pars., non figures.

*Terebratula substriata alba*—Quenstedt, 1858.

Der Jura, page 635, tab. 78,  
fig. 30.

*Terebratulina quenstedti*—Suess, 1858.

Die Brachiopoden der Stramberger  
schichten, page 38.

*Terebratula substriata*—Quenstedt, 1867.

Handbuch der Petrefacten-kunde,  
page 551, tab. 47, fig. 7.

*Terebratula substriata alba*—Quenstedt, 1871.

Die Brachiopoden, page 245,  
plate 44, fig. 13.

*Terebratula substriata*—De Loriol, 1878.

Monographie paléontologique de la  
zone à *Ammonites tenuilobatus* de  
Baden, page 181, plate xxiii.,  
fig. 33.

*Terebratulina substriata*—Engel, 1883.

Geognostische Wegweiser durch  
Württemberg, page 204, tab. 5,  
fig. 19.

*Terebratulina substriata* var. *Suffieldensis*—J. F. Walker,  
1892. Geological Magazine, page  
364.

HISTORY.—Schlotheim states that *Terebratulites substriatus* is covered with very fine radiating striae, and that it occurs at Schaffloch near Amberg: he gives no figures.

Zieten gives the upper beds of Oolite Limestone near Gruibingen as the locality for his *Terebratula striatula*; the specimen figured appears to be *Terebratulina substriata* var. *alba*.

von Buch gives a long description of *Terebratula substriata*, in which he states that it is, with the exception of the beak, almost round, and it is covered with fine plaits, and he notices the absence of the ear-like projections of the smaller valve.

Davidson refers this shell to the genus *Terebratulina*, but he gives a figure of *Terebratula substriata* var. *silicea*.

Quenstedt, in 1858, ("Der Jura") divides this species into *Terebratula substriata alba* from the Weiss Jura *gamma*, and *Terebratula substriata silicea* from the Weiss Jura *epsilon* of Nattheim.

Suess, in 1858, separates the *Terebratulina* which occurs in the Weiss Jura *gamma* from *Terebratulina substriata*, Schlotheim, and gives it the name of *Terebratulina Quenstedti*, and reserves the name *Terebratulina substriata* for Nattheim specimens from the Weiss Jura *epsilon*.

Quenstedt ("Die Brachiopoden") remarks that Schlotheim's specimens from Amberg are nearer to *Terebratulina substriata alba* than to *Terebratulina substriata silicea*.

De Loriol "Monographie paléontologie de la zone à *Ammonites tenuilobatus* de Baden" agrees with Quenstedt, and says that it is *Terebratulina substriata silicea* which ought to have had another name, as it differs in shape; in strong widely separated ribs; in its beak and larger size; it is also more strongly folded. The specimen, plate xiii., fig. 33, figured by De Loriol, appears to agree very closely with our Yorkshire specimens. He says that the striae

are so fine that they can scarcely be seen without the aid of a lens, and that they are finer and more numerous than those on the German specimens from the Weiss Jura *gamma*.

DESCRIPTION.—The Yorkshire variety of *Terebratulina substriata* has the length, excluding the beak, about equal the width, in full grown specimens; but in some of the younger specimens the shell has its greatest width about the middle of the valve, and rapidly tapers towards the beak, giving the shell an elongated form, although the proportion of the greatest width to the length is the same as in the circular specimens. The shell is almost flat, with a slight convexity of both valves, the greatest thickness being about the centre of the shell, gradually becoming thinner towards the lateral margins. The larger valve has a slight wave-like depression commencing at the front margin, and gradually disappearing towards the beak, corresponding to a similar elevation on the smaller valve.

The beak is almost straight; the foramen is large, and the deltidium is absent; there are no ear-like projections. Both valves are covered with very fine and numerous striae, which radiate from the beak towards the front margin of the valves. The sandy matrix of the deposit in which these shells are found is not favourable to the good preservation of the shell surface, so the striae often appear to have been worn.

DIMENSIONS.—The following is the greatest length, greatest width, and greatest thickness of the shells, given in millimetres:—

|                       |    |         |          |          |
|-----------------------|----|---------|----------|----------|
| Large specimen        | .. | 13 m.m. | 11 m.m.  | 5 m.m.   |
| Medium specimen       | .. | 10 m.m. | 8 m.m.   | 4 m.m.   |
| Small specimen        | .. | 7 m.m.  | 6 m.m.   | 3 m.m.   |
| An elongated specimen |    | 10 m.m. | 7·5 m.m. | 4·5 m.m. |

DIFFERENCES.—*Terebratulina substriata* var. *Suffieldensis* is easily separated from *Zeilleria Hudlestoni*, which occurs in the same bed, by being a much flatter shell, by the form of its beak, and foramen, also by its very fine striated surface. This variety differs from *Terebratulina substriata* var. *alba* by the extreme fineness of its striae; by its more rounded shape when full grown, and by the fold being only slightly developed, the shell being generally flatter. But the shell is more closely related to var. *alba* than to var. *silicea*.

LOCALITY.—*Terebratulina substriata* occurs at Suffield, near Scarborough, in the Lower Coral rag, zone of *Ammonites perarmatus*. The bed in which they occur is described by Blake and Hudleston, Quarterly Journal Geological Society, vol. xxxiii., page 331, as Crystalline gritty doggers in a brownish brash, containing abundance of *Spongia floriceps*, and a small *Waldheimia* (*Zeilleria Hudlestoni*), and many other fossils. This quarry has been long noted for the quantity of small sponges, *Spongia floriceps*, *Calcispongia corallina*, and several new species discovered by S. Chadwick, and to be described by Dr. Hinde. It is to be noticed that Quenstedt “Die Brachiopoden,” page 244, states that this Brachiopod appears to prefer a spongy layer as its dwelling place. *Terebratulina substriata* is much rarer than *Zeilleria Hudlestoni* which occurs abundantly in this bed, although specimens of it can always be found by careful search; the flat form often being covered by a coating of sand, which makes it difficult to find; yet many specimens of this shell have been recently found by myself, S. Chadwick, W. G. Lether, and other local Geologists

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## On *Omosaurus Phillipsi* (Seeley).

By H. G. SEELEY, F.R.S., Honorary Member of the Yorkshire Philosophical Society.

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The remains of terrestrial reptiles from the Coralline Oolite are recorded as *Megalosaurus Bucklandi*, and there is no doubt that the superb tooth in the Museum of the Yorkshire Philosophical Society is correctly referred to *Megalosaurus*, unless allied genera should prove to have teeth of the same type; but till some parts of the skeleton are known which will permit of comparison with the type from the Stonesfield slate, it may be premature to affirm that the species is the same in both deposits.

During a recent visit to the Museum I was able to add another terrestrial reptile to the list in the identification of a femur which is referable to a small species of *Omosaurus*, unless that name should give place to *Priodontognathus*.

The specimen has upon it the following label, which is an excellent example of a scientific record of discovery: "Found A.D. 1838, on the Earl of Carlisle's estate at Slingsby, Yorkshire, imbedded in a thin stratum of earth and calcareous matter between two of the upper strata of limestone in a quarry three quarters of a mile east of the village of Slingsby, and 50 yards south of the high road to Malton. The lowest rise in the north side of the Howardian Hills here forms a gentle knoll-shaped elevation having a diameter of three to four hundred yards."

This femur is at present in three fragments. The proximal end is somewhat compressed, and a slight slip in the rock has cut obliquely through the distal end of the bone, without any great displacement. When the three pieces are put together they leave no doubt that they once formed a single bone, which was twenty-five inches long. This left femur is straight with the proximal and distal ends nearly in the same plane. The distal end is moderately thickened from front to back, though the inner condyle is a little broken, and both the proximal and distal ends are much wider from side to side than the shaft, which has concave sides and is somewhat slender.

The proximal articular end has a transverse width of  $5\frac{1}{2}$  inches as preserved, but about one inch appears to be lost from the inner articular extremity or articular ball of the bone. The proximal articular surface is obliquely truncated, for the inner half is convex and somewhat hemispherical, extending an inch further proximally than the outer part, which is flattened, though slightly convex from front to back. The thickness of the proximal end is about  $2\frac{1}{2}$  inches.

The middle of the shaft is about  $1\frac{3}{4}$  inches thick. Its least transverse width is  $2\frac{7}{8}$  inches. It is ovate in section. The medullary cavity measures from an inch to an inch and a half wide, by three-quarters of an inch deep.

The inner side of the bone is concave in length, and regularly convex from above downward and backward, supposing the femur to have been carried in a nearly horizontal position. The external side of the bone is at first convex from above downward near to the proximal end, and then it becomes flattened. Towards the proximal end its external lateral contour is distinctly convex, while in the greater part of the length of the shaft it is markedly concave.

On the antero-superior surface of the bone,  $2\frac{3}{4}$  inches below the proximal cartilaginous articular surface was an elongated trochanter or ridge now broken away, but which does not appear to have been much elevated. Its base is fully four inches long, nearly straight, three-quarters of an inch wide, rounded at the proximal end, and narrowing distally to a point. It is parallel to the inner border of the bone, so that while its proximal end is about one and a half inch from the outer margin of the bone, its distal end is less than three-quarters of an inch from that margin. Its elevation makes the middle width of the bone, which is internal to it, to be longitudinally concave. As the line of the trochanter is followed down the shaft, it makes the outer side of the bone a little thicker than the inner side.

The infero-posterior surface of the bone is flattened, and slightly concave from side to side.

The distal end of the bone widens till it measures five and a half inches in transverse width; and the articulation is nearly four inches deep on the inner side, where the bone is

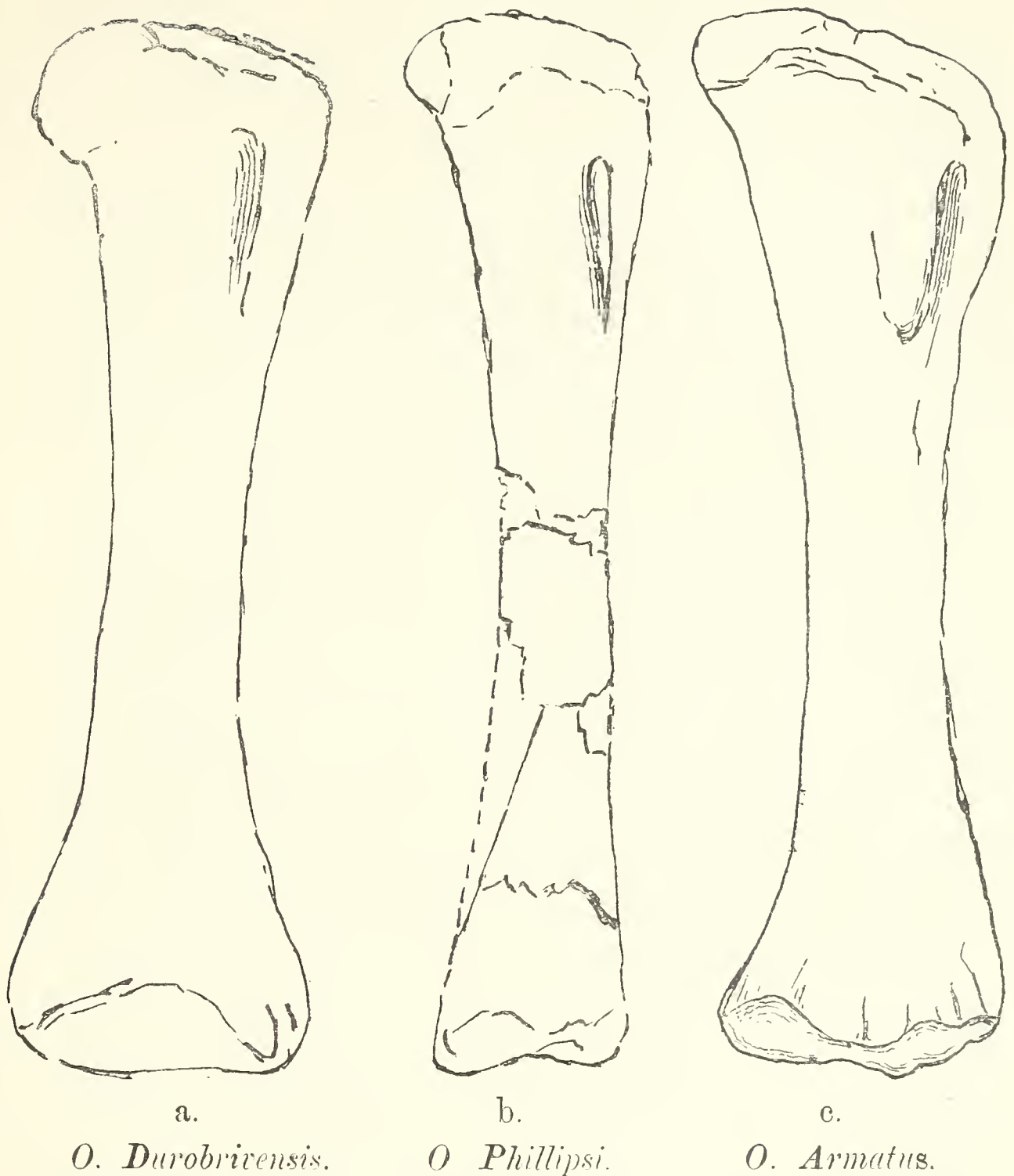
thickest and flattened in the way commonly seen in Ornithischian reptiles. Anteriorly, there is a concave channel between the two trochlear ridges which are but slightly elevated in front of the distal articulation. The inner ridge is narrower and more elevated than the outer ridge, which has a wider, rounded aspect.

On the external side of the distal articulation there is the usual concave longitudinal channel towards the posterior margin, which, being defined by a transverse widening of the bone, makes this external surface convex from above downward, and contributes to compress the external condyle, which becomes the distal termination of a convex ridge extending down the shaft at about one inch from its external border. The inner condyle was moderately developed, though larger, and it was rounded. Its base is two inches wide. The whole of the under side of the distal end of the shaft is concave from side to side.

The contour of the articulation seen from the distal extremity is transversely oblong. The surface is rounded downward and backward: with an almost inappreciable depression between the inner and outer portions. The inner condyle extends a little further distally than the outer condyle; and this leads to the inference that the femora diverged outward in a way that would be consistent with a prone condition of the animal's body.

Such are the characters of the femur which has remained for 55 years the only evidence of this animal. Every detail of structure proves it to conform so closely to the type which is known as *Omosaurus* that it may be regarded as indicating a new species of that genus. Its generic identification is based upon the straight compressed shaft in which there is no appreciable twist; on the proximal trochanteric ridge, the absence of a trochanter on the middle of the inner side of the shaft, and the forms, proportions and characters of the proximal and distal ends. *Omosaurus* is known from the Oxford and Kimeridge Clays. The former evidenced by the *O. durobriensis* (Hulke) based upon the specimen in the British Museum obtained from near Peterborough by Mr. A. N. Leeds, and the latter by *O. armatus* (Owen) from Swindon which is also in

FIG. 1.



In this figure the left femoral bones are reduced to the same absolute length to show the differences of proportion in their proximal and distal ends. By the omission of a line in contour of the distal articulation there is an appearance of difference in *O. durobrivensis* which does not exist.

the British Museum. The Slingsby fossil differs from the Oxford clay type, which has the femur nearly 40 inches long, in having the proximal end relatively rather narrower, and relatively wider below the articular surface, in so far as can be judged from the present state of preservation. The trochanteric ridge does not appear to have been prolonged so far proximally. The distal end is relatively much narrower, and the articular surface on the front of the shaft is similar. These differences seem to me consistent with reference of the Slingsby fossil to a different and smaller

species with a less heavy type of body. The Kimeridge Clay femur is relatively heavier than that from the Oxford Clay, and widens at the distal end in the the same way, but its proximal end is shaped as in the Corallian species, but is relatively wider.

Professor Marsh has referred the Kimeridge Clay fossil from Swindon to the American genus discovered and restored by himself named *Stegosaurus*. Mr. Hulke has intimated his belief that the Oxford Clay species should be referred to that genus if it proves to have dermal armour of the plate-like type figured by Professor Marsh, which Mr. Hulke describes (Quart. Jour. Geol. Soc., Vol. xliii, p. 702), and Mr. Lydekker (Cat. Foss. Rept. and Amph. Brit. Mus., part 4, p. 251,) adopts this identification. It seems to me that no sufficient evidence has yet been brought forward to justify the identification. The massive thickness of both the proximal and distal ends of the femur in *Stegosaurus* is not paralleled, judging from Professor Marsh's figures, in any of the femora which have been referred to *Omosaurus*. *Stegosaurus* appears to have been a heavier type of animal. There is no proof that *Omosaurus* possessed the great dorsal-crest of armour plates from which *Stegosaurus* takes its name, which are shown in Professor Marsh's restoration of the skeleton. I concur with Mr. A. Smith Woodward in regarding the supposed armour plates of *Omosaurus* as the opercular bones of a fish which he has named *Leedsia*.

There is no doubt that *Omosaurus* is allied to *Stegosaurus*, though the affinity may not be so close as has been supposed. And the relationship is important as showing the nature of the skeleton which was associated with this Yorkshire femur. The teeth of *Stegosaurus* are of the family type of *Acanthopholis*; and teeth of this kind may be predicated for the Slingsby fossil. In *Stegosaurus ungulatus* as restored by Marsh, the length of the head of the animal is seen to be less than half the length of the femur. And if the head of the Slingsby animal was relatively as long it may have measured about twelve inches in length.

In 1875 I brought under the notice of the Geological Society a new Dinosaur, the maxillary bone of which is about

five inches long. It has teeth which closely resemble those of *Acanthopholis* and *Scelidosaurus*. There was no evidence of the stratigraphical position of the fossil other than the matrix in which it was contained which resembled Calcareous Grit, and a fossil within it which is a typical example of the variety of *Pecten vagans*, named *P. fibrosus*. On this evidence Professor Judd, F.R.S., and Mr. R. Etheridge, F.R.S., at the time the paper was read, suggested that the fossil was from the Calcareous Grit of Yorkshire. The specimen, now in the Woodwardian Museum, was formerly in the collection of the late Dr. Forbes Young, whose executors presented it to the University of Cambridge in 1861, but I am unable to trace its earlier history. It is possible that it may be a portion of the head of the Slingsby reptile. It is almost exactly of the size; and has the tooth character which such a specimen should exhibit; and the matrix favours the identification. If this suggestion should be supported by further evidence, the name *Priodontognathus* may take precedence of *Omosaurus*, as having been founded on cranial characters, though both were proposed in the same year. As the name *Omosaurus* has been objected to by some writers as preoccupied by Leidy, it may be convenient to mention that *Omosaurus perplexus* (Leidy) 1856 (Proc. Acad. Nat. Sci. Philad. viii.) was founded on remains from the coal field of Chatham County, North Carolina, with teeth of varied type, biconcave vertebræ much constricted as in *Palæosaurus* and *Clepsysaurus*; and the animal is classed as an Enaliosaurian. I am not aware that either Leidy or anyone else has fully described or figured it. Hence if the *Omosaurus* (Owen) of 1875 is a synonym of *Priodontognathus* there may be an advantage in retaining the latter name. In the belief that this identification is likely to be made, I suggest for the femur the name *Omosaurus Phillipsi* because the jaw is already named *Priodontognathus Phillipsi*.

I am glad to have this opportunity of expressing my thanks to Mr. J. F. Walker, M.A., F.G.S., for the opportunity of studying this specimen; and I desire also to acknowledge the aid in my examination obligingly given by Mr. Platnauer. I trust the interest which centres round this specimen may result in the discovery of other evidences of the animal to which it belonged.

# NOTES ON A POST-TERTIARY DEPOSIT IN SUSSEX.

BY ALFRED BELL.

For some years past the writer has been working upon the Pliocene and later deposits of the British Islands, and in doing so it occurred to him that by correllating the faunas yielded by each locality, these might be grouped so that in some measure a slight idea of the changes in the relations of land and water might be obtained, or some indications of the successive stages whereby the British Islands assumed their present outlines arrived at. Some of the conclusions arrived at have been already published ("Sequence of the later Tertiaries in Great Britain," *Geological Magazine*, February, 1886), but it was not till after the writer had worked out the materials obtained during a personal examination of the several deposits on the east coast of Ireland from the earlier Wexford gravels to the latest deposits on the Antrim coast (Rep. Brit. Ass., 1887-1890), that these ideas assumed a more definite shape.

These views were further strengthened after examination of the fossils from the Pliocene deposits in the St. Erth Valley, Cornwall. It had been already noticed that the fauna in respect to extinct species came nearer to that of the older or lowest part of the well known Crag deposits at Walton-on-the-Naze than to any other horizon. Inasmuch as some of these extinct forms are also present in the Irish deposits in counties Wexford and Dublin, and in the Isle of Man, it is evident that some line of water-way must have been existent at some time by which these species could have travelled in such opposite directions as the North Sea and the Irish Channel.

It may be noted here, before passing on to the immediate subject of this paper, that the so-called Lower, Middle and Upper drifts of the Irish coasts, have nothing in common with the more recent Lower, Middle, and Upper Boulder Clays of the N.W. of England and Wales. This I hope to demonstrate at a future time.

A singular deposit bearing upon this question exists upon the shores of the Selsey Peninsula, a few miles south of Chichester in Sussex, discovered by the late Mr. Dixon, and mentioned in his volume on the Geology of Sussex, and examined from time to time, as opportunity offered, by various observers. Situated between tide marks it is rarely accessible, so much sand and shingle overlying it derived from the waste of the cliffs which recede nearly 6 feet yearly, that it is only by piecemeal the general structure of the beds can be made out.

The chief interest of the deposit centres in the rich and unique fauna, of which the appended lists exhibit the result of some 25 years' research, numbering over 330 species in nearly all classes of organic life, the series exhibiting a purely southern facies, free from any admixture of northern or boreal forms, and therefore requiring peculiar environments to account for their accumulation.

I may here briefly refer to Mr. Godwin-Austen's paper (Quart. Journ. Geol. Soc., Lond., 1855), in which he sketches out the lie of the strata. His diagram gives a shelly deposit, the "mud deposit" of Dixon, as reposing upon a red freshwater gravel, and covered by a stiff yellow clay containing ice-transported erratics of large size, derived from an area in the English Channel now destroyed, this in its turn being over-spread with the flint gravels that are so prevalent on the south coast.

The "mud deposit" here referred to, I find after repeated examinations, resolves itself into more than one aspect. It may be premised that the whole of the foreshore being covered with debris and constantly shifting, the details are presented in very fragmentary portions, but I have noted them sufficiently for the purpose required.

The extreme west of the section consists of some indurated masses of Eocene Sands, penetrated by numerous crypts bored by *Pholas crispata*, the shells occasionally still remaining in situ. To the east and having a considerable extension inland, a stiff yellow chalky clay rises in hummocks above the sand. This contains but few traces of life, and only those that are proper to shallow marine flats; such as the common cockle,

mussel, periwinkle, and *Scrobicularia piperata*. Adjacent to, and resting upon, this yellow clay occurs a very hard dense black mud, difficult to break down and which when heated and suddenly cooled in water gives off a strong volume of sulphuretted hydrogen, the residue when washed containing much vegetable matter, probably seaweed, of which I find several species too far gone for accurate determination. A few seeds of land plants, *Ranunculus repens*, *Rubus fruticosus* and *Rhinanthus cristagalli*, and fragments of Coleoptera are occasionally met with.

In this horizon derived Eocene forms are not uncommon but are easily distinguished from the more recent types by their colour, or the greenish gray sand in their cavities. In the absence of these indications, considering the affinities of the fauna of the mud deposit which will appear further on, it is difficult to determine in the case of such genera as *Leda*, *Cardita*, *Arca*, &c., whether they are derivative or not, the specific differences being like the individual, small, between the Eocene and later forms.

The Foraminifera are also of somewhat uncertain age, but as a rule the larger hard mud species are such Eocene forms as *Nummulites*, *Discorbina*, and *Alveolina*, these constituting the principal genera.

Fish Otoliths are common but are probably of the same origin, although some of them are very much fresher than others in appearance.

The intervening space is filled with a fine silty sand, the present width not extending above 150 to 200 yards, the higher and wider spreading portions of the deposit having been bodily removed. How thick this bed was originally there are no means of ascertaining, but as the present level of the silt bed is 4 feet below that of the *Pholades* which are full of the debris, it was probably much more extensive and widely developed. This area is replete with mollusca in their original positions, the interior of the larger bivalves abounding in the most delicate molluscs, hydroids and polyzoa in exquisite preservation.

The entire group of deposits rests upon a freshwater gravel, and there is no evidence, indeed it is almost a certainty, that

up till now, with the exception of the inroads at different periods of the earlier and later Pliocene seas near Folkestone and St. Erth, the whole of the area of the English Channel had been non-marine from the close of the Oligocenes, or early Miocenes.

As already stated, the fauna of the yellow clay is one proper to muddy flats, brackish rather than saline, indicating the proximity of fresh water. That of the hard mud postulates different conditions; creek shells are more prevalent, the *Scrobicularia* is replaced by an allied but different species, and many marine deeper water forms make their appearance. Some of these are rolled as if transported after death from deeper water, but the fauna as a whole would indicate the bathymetrical range of the hard mud bed to be at, or just below, the verge of lower tide mark.

In the last or silt stage, the creek shells become much scarcer, and a true marine fauna obtains. The *Pholas* beds trend westwards inland, and some years back traces of the silt were found towards Medmeney. In this direction the silt bed became the recipient of a land fauna brought in by a river flowing eastwards as shown by the mammalia and neo-marine mollusca obtained between East Wittering to Danner Gap and in the silt itself.

Reasoning from the above data we have in successive order of appearance, 1st, a fluviatile gravel with beds of fresh water shell bearing marls, then 2nd, estuarine clays deepening into 3rd, a creek or littoral-laminarian bed, and finally into 4th, a laminarian-coralline or deep water deposit. As the *Pholades*, the yellow clay, and hard mud beds, are on or near the same level, and the *Pholades* are replete with silt and silt shells, the presumption is that the silt bed at one time existed over all, and the mere fact of the yellow and hard mud beds occurring so high above the level of the present silt appears to be owing to their extreme tenacity and resistance to denudation rather than to their lateness of origin.

An analysis of the lists of organic remains appended

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Since the above was written, Mr. C. Reid has found at Stone, on the Hampshire coast, a deposit of similar age containing elephant remains and plants, including a S. European Maple: probably a remnant of the Selsey river here referred to.

excluding all those that are of doubtful origin, either Eocene or more recent, gives the following result.—Neo-marine, 8 Mammals, 10 Molluscs, some fragments of insects, and 3 plants. 2nd, Marine, 2 Pisces, 6 Crustacea, 17 Entomostraca, 4 Cirripedia, 4 Annelida, 3 Echinoderms, 216 Molluscs, 10 Polyzoa, 5 Foraminifera, 5 Actinozoa, algae, &c.

### Mammalia.

|                               |                          |
|-------------------------------|--------------------------|
| Capra hircus, Gmel.           | Elephas antiquus, Falc.  |
| Cervus elaphus, L.            | ? „ meridionalis, Nesti. |
| Bos primigenius, Boj.         | „ primigenius, Blum.     |
| * Rhinoceros leptorhinus, Ow. | Equus eaballus, L.       |

\* This species was found at East Wittering. I obtained a fine humerus of this or the tichorhine species from the Selsey shore beds.

‡ See Rev. O. Fisher in Dixon Geol. Sussex, 2nd edit.. p. 55.

### Pisces.

Galeus eanis, L. (tooth) and Vertebrae of Teleostean fishes. Also numerous otoliths of uncertain age, mostly, if not all, of Eocene age, derived from the Bracklesham sands. (E. T. Newton, F.G.S.)

### Crustacea.

|                             |                                    |
|-----------------------------|------------------------------------|
| Calappa sp.                 | Pagurus bernhardus, L.             |
| Carcinus maenas, L.         | Pilumnus hirtellus.                |
| Galathea squamifera, Leach. | Stenorhynchus tenuirostris, Leach. |

### † Ostracoda.

|   |                                                   |
|---|---------------------------------------------------|
|   | Cythere albomaculata, (Baird), moderately common. |
|   | „ convexa, (Baird), frequent.                     |
| * | „ costellata, (Roemer), frequent.                 |
|   | „ jonesii, (Baird), rare.                         |
|   | „ lutea, (Muller), not common.                    |
|   | „ pellucida, (Baird), not common.                 |
| * | „ plicata, (Munster), frequent.                   |
|   | „ pulchella, (Brady), not common.                 |
|   | „ tuberculata, (G. O. Sars), rare.                |
|   | Cytheridea elongata, (Brady), not common.         |
|   | „ punctillata, (Brady), not common.               |
|   | „ torosa, (Jones), frequent.                      |
|   | Loxoconcha impressa, (Baird) frequent.            |
|   | Xestoleberis depressa, (G. O. Sars), frequent.    |
|   | Cytherois fiseheri, (G. O. Sars), not common.     |

\* From an older deposit.

† Note. These are given on the authority of Thos. Scott, Esq., F.L.S., also *Bairdia* sp., and *Cytheridea cornuta*, Brady.

### Marine Mollusca.

|                                  |                              |
|----------------------------------|------------------------------|
| Dischides—                       | Chiton—                      |
| * bifissum . . . . . S. V. Wood. | * disrepans . . . . . Brown. |
| Dentalium—                       | * fascicularis . . . . . L.  |
| candidum . . . . . Jeffr.        | marginatus . . . . . Penn.   |
| * dentalis . . . . . L.          | siculus . . . . . Gray.      |
| panormum . . . . . Chemn.        | Patella—                     |
| * tarentinum . . . . . Lam.      | vulgata . . . . . L.         |

- Tectura—  
 \* virginea ..... Müll.  
 Helcion—  
 pellucidum ..... L.  
 Fissurella—  
 \* costaria ..... Bast.  
 \* graeca ..... L.  
 Trochus—  
 \* cinerarius ..... L.  
 exasperatus ..... Pult.  
 lineatus ..... Da. C.  
 magus ..... L.  
 striatus ..... L.  
 \* tumidus ..... Mont.  
 \* turgidulus ..... Broc.  
 umbilicatus ..... Mont.  
 \* zizyphinus ..... L.  
 Solariella—  
 approximata .. A. Bell.  
 acutangula .... A. Bell.  
 Phasianella—  
 pullus ..... L.  
 Cyclostrema—  
 elegantula .... Phil.  
 nitens ..... Phil.  
 Lacuna—  
 divaricata .... Fabr.  
 pallidula ..... Da. C.  
 puteolus ..... Turton.  
 Cithna—  
 minima ..... A. Bell.  
 Littorina—  
 littorea ..... L.  
 neritoides ..... L.  
 obtusata ..... Gm.  
 rudis ..... Maton.  
 var. nigrolineata Phil.  
 „ saxatilis . Johnst.  
 „ tenebrosa . Mont.  
 Homalogyra—  
 \* atomus ..... Phil.  
 rota ..... F. & H.  
 Jeffreysia—  
 diaphana ..... Ald.  
 Hydrobia—  
 compactilis .... A. Bell.  
 ulvæ ..... Penn.  
 subumbilicata . Mont.  
 ventrosa ..... Mont.  
 Rissoa—  
 bicarinata .... A. Bell.  
 cimex ..... L.  
 costata ..... Ad.  
 \* costulata ..... Ald.  
 deliciosa ..... Jeffr.  
 inconspicua .... Ald.  
 lactea ..... Mich.  
 membranacea Ad.  
 (var) elata .. Phil.  
 „ venusta.. Phil.  
 Montagui .... Payr.  
 multistriata .. A. Bell.  
 parva ..... Da. C.  
 (var) interrupta Ad.  
 punctura ..... Mont.  
 scutula ..... A. Bell.
- Rissoa—  
 semistriata .... Mont.  
 \* soluta ..... Phil.  
 \* striata ..... Ad.  
 (var) arctica.. Lor.  
 \* reticulata..... Mont.  
 striatula .... Mont.  
 Barlecia—  
 cingulata .... A. Bell.  
 Turritella—  
 \* incrassata .... Sow.  
 terebra ..... L.  
 Mesalia—  
 brevialis ..... Lam.  
 Odestomia—  
 \* acuta ..... Jeff.  
 \* conoidea ..... Broc.  
 elongata ..... A. Bell.  
 pallida ..... Mont.  
 \* plicata ..... Mont.  
 rissoides ..... Hanl.  
 turrita ..... Hanl.  
 Chemnitzia—  
 \* clathrata ..... Jeff.  
 \* eximia ..... Jeff.  
 fulvocincta .... Thomp.  
 formosa ..... Jeff.  
 gracilis ..... Phil.  
 lactea ..... L.  
 rufa ..... Phil.  
 \* rufescens ..... E. F.  
 scalaris ..... Phil.  
 spiralis ..... Mont.  
 \* suturalis ..... Phil.  
 „ indistincta .... Mont.  
 interstincta .... Mont.  
 Scalaria—  
 communis .... Lam.  
 \* foliacea ..... Sow.  
 \* sp. ....  
 Aclis—  
 \* unica ..... Mont.  
 Natica—  
 \* alderi ..... E. F.  
 \* catena ..... Da. C.  
 Adeorbis—  
 \* sub-carinata .. Mont.  
 \* supranitida .... S. V. W.  
 Cerithium—  
 reticulatum .... Da. C.  
 Cerithiopsis—  
 \* metaxa..... Delle Ch.  
 Purpura—  
 \* lapillus ..... L.  
 Buccinum—  
 \* undatum .... L.  
 Nassa—  
 \* incrassata .... Shaw.  
 nitida ..... Jeffr.  
 \* pygmæa ..... Lam.  
 reticulata..... L.  
 Nesæa—  
 lineolata .... Tiberi.  
 Murex—  
 erinaceus .... L.

\* Signifies species common to both the Selsey and the Crag deposits.

Defrancia—  
 \* linearis ..... Mont.  
 \* reticulata ..... Ren.  
 Pleurotoma—  
 \* bertrandi ..... Payr.  
 \* lævigata ..... Phil.  
 rufa ..... Mont.  
 (var)semicostata Jeffr.  
 septangularis .. Mont.  
 Cypræa—  
 \* europea ..... Mont.  
 Utriculus—  
 mammillatus .. Phil.  
 \* obtusus ..... Mont.  
 lajonkaireana .. Bast.  
 \* truncatulus .... Brug.  
 Cylichna—  
 nitidula ..... Lov.  
 Bulla—  
 hylatis ..... L.  
 \* utriculus ..... Broc.  
 Conovulus—  
 bidentatus .... Mont.  
 myosotis .... Drap.  
 Otina—  
 otis ..... Turt.  
 Anomia—  
 \* ephippium .... L.  
 Ostrea—  
 edulis ..... L.  
 (var) parasitica  
 \* cochlear ..... Poli.  
 lusitanica .....  
 Pecten—  
 \* aratus ..... Gm.  
 flexuosus ..... Poli.  
 hyalinus ..... Poli.  
 \* maximus ..... L.  
 \* opercularis .... L.  
 \* (var) audouinii Payr.  
 proteus ..... Lam.  
 \* tigrinus ..... Penn.  
 varius ..... L.  
 Mytilus—  
 \* edulis ..... L.  
 \* (var) unguatus L.  
 \* phaseolinus .... Phil.  
 Modiola—  
 modiolus ..... L.  
 Modiolaria—  
 \* discors ..... L.  
 \* marmorata .... E. F.  
 Crenella—  
 rhombea ..... Berk.  
 Nucula—  
 \* nucleus ..... L.  
 radiata ..... Hanl.  
 sulcata ..... Brown.  
 \* tenuis ..... Mont.  
 Lepton—  
 \* nitidum ..... Turt.  
 (var) pisidialis Jeffr.  
 Montacuta—  
 \* bidentata ..... Turt.  
 \* ferruginosa .... Mont.

Lasæa—  
 rubra ..... Mont.  
 Kellia—  
 \* ambigua ..... Nyst.  
 suborbicularis.. Mont.  
 Cardium—  
 echinatum .... L.  
 \* edule ..... L.  
 \* (var)rusticum Ch.  
 exiguum ..... Gm.  
 \* fasciatum .... Mont.  
 inæqualis .... A. Bell.  
 minimum .... Phil.  
 \* nodosum ..... Turt.  
 papillosum .... Poli.  
 \* strigilliferum .. S. V. W.  
 Astarte—  
 \* pygmæa ..... Munst.  
 Cardita—  
 \* chamæformis ..  
 trapezia ..... L.  
 Loripes—  
 lacteus ..... L.  
 Lucina—  
 \* borealis ..... L.  
 Axinus—  
 \* flexuosus ..... Mont.  
 Diplodonta—  
 \* rotundata .... Mont.  
 Cyamium—  
 \* minutum ..... Fabr.  
 Lucinopsis—  
 \* Lajonkairii .... Payr.  
 Artemis—  
 \* lineta ..... Pult.  
 Cytherea—  
 \* chione ..... L.  
 Venus—  
 \* ovata ..... Pem.  
 verrucosa ..... L.  
 Tapes—  
 aureus ..... Gm.  
 (var) quadrata Jeffr.  
 decussata ..... L.  
 perovalis ..... S. V. W.  
 pullastra ..... L.  
 \* virginea ..... W. Wood.  
 (var)sarniensis Turt.  
 Tellina—  
 balthica ..... L.  
 Gastrana—  
 fragilis ..... L.  
 Psammobia—  
 \* ferröensis .... Ch.  
 \* vespertina .... Ch.  
 Mactra—  
 \* stultorum .... L.  
 solida ..... L.  
 \* subtruncata .... Da. C.  
 Donax—  
 \* vittatus ..... Da. C.  
 (var) nitidus Jeffr.  
 Lutraria—  
 \* elliptica ..... Lam.  
 oblonga ..... Ch.  
 rugosa ..... Ch.

|                         |          |
|-------------------------|----------|
| Scrobicularia—          |          |
| piperata . . . . .      | Gm.      |
| Syndosmya—              |          |
| *    alba . . . . .     | W. Wood. |
| tenuis . . . . .        | Mont.    |
| Solen—                  |          |
| siliqua . . . . .       | L.       |
| vagina . . . . .        | L.       |
| Pandora—                |          |
| *    inaequivalvis ..   | L.       |
| Corbula—                |          |
| *    gibba . . . . .    | Olivi.   |
| Panopea—                |          |
| *    plicata . . . . .  | Mont.    |
| Saxicava—               |          |
| rugosa . . . . .        | L.       |
| Mya—                    |          |
| arenaria . . . . .      | L.       |
| *    truncata . . . . . | L.       |
| Thracia—                |          |
| *    papyracea . . . .  | Poli.    |
| Pholas—                 |          |
| candida . . . . .       | L.       |
| *    crispata . . . . . | L.       |
| dactylus . . . . .      | L.       |

**LAND & FRESHWATER.**

|                     |       |
|---------------------|-------|
| Bythinia—           |       |
| tentaculata . . . . | L.    |
| Helix—              |       |
| hispida . . . . .   | L.    |
| hortensis . . . . . | Müll. |
| nemoralis . . . . . | L.    |
| Limnæa—             |       |
| palustris . . . . . | Müll. |
| peregra . . . . .   | Müll. |
| Planorbis—          |       |
| complanatus ..      | L.    |
| spirorbis . . . . . | Müll. |
| vortex . . . . .    | L.    |
| Pisidium—           |       |
| amnicum . . . . .   | Müll. |

**Polyzoa.**

|                                      |                                |
|--------------------------------------|--------------------------------|
| Cellepora pumicosa, L.               | † Micropora regularis, d'Orb.  |
| Cribrilina radiata, Moll.            | Mucronella Peachei, Johnst.    |
| Crisia denticulata, Lamk.            | Porella concinna Busk.         |
| " (var selsiensis A.B.)              | Schizoporella sp.              |
| * Diastopora regularis, d'Orb.       | Scrupocellaria scabra, V. Ben. |
| Lepralia pallasiana, Moll.           | " reptans, L.                  |
| Membranipora—                        | Tubulipora flabellaris, Fabr.  |
| lineata L.                           |                                |
| membranacea L.                       |                                |
| monostachys Busk.                    |                                |
| reticulum, L.= <i>M. Lacroixii</i> . |                                |
| trifoliata, S. Wood.                 |                                |

\* A beautiful little species and very distinct, may very well bear a varietal name. G. R. Vine.

† Unlike any British form of *Micropora* known to me. G. R. Vine.

**Annelida.**

|                             |                             |
|-----------------------------|-----------------------------|
| Sabellaria.                 | Spirorbis nautiloides, Lam. |
| Serpula contortuplicata, L. | Vermilia triquetra, L.      |

**Echinodermata.**

|                                       |                            |
|---------------------------------------|----------------------------|
| Echinoecyamus pusillus, Müll.         | Spatangus purpureus, Müll. |
| Sphærechinus brevispinosus, (spines). |                            |

**Foraminifera.**

(Determined by F. W. Millet, Esq., Marazion.)

|                                                |
|------------------------------------------------|
| Nubecularia lucifuga, DeFrance, rare.          |
| Biloculina ringens, Lamarck, sp., very common. |
| Spiroloculina grata, Terquem, very rare.       |
| Miliolina seminulum, L., sp., very common.     |
| — oblonga, Montagu, sp., common.               |
| — trigonula, Lamarck, sp., common.             |
| — secans, d'Orbigny, sp., rare.                |
| — subrotunda, Montagu, sp., very rare.         |
| — venusta, Karrea, sp., rare.                  |
| — saxorum, Lamarck, sp., common.               |

- Sigmoilina tenuis*, Czjzek, sp., very rare.  
*Peneroplis cylindraceus*, Lamarck, sp., common.  
*Artieulina suleata*, Reuss, very rare.  
*Alveolina sabulosa*, Montfort, very common.  
*Orbitolites complanata*, Lamarek.  
*Rhabdammina*, ? rare.  
*Haplophragmium agglutinans*, d'Orbigny, sp., rare.  
*Valvulina austriaca*, d'Orbigny, rare.  
 ——— *triangularis*, d'Orbigny (Bulimine form). common.  
*Verneuilina polystropha*, Reuss, rare.  
*Bolivina decorata*, Jones, very rare.  
 ——— *punctata*, d'Orbigny, very rare.  
*Lagena williamsoni*, Alcock, sp., very rare.  
 ——— *clavata*, d'Orbigny, sp., very rare.  
 ——— *lucida*, Williamson, sp., very rare.  
 ——— *orbignyana*, Seguenza, sp., very rare.  
 ——— *squamosa*, Montagu, sp., very rare.  
*Cristellaria eultrata*, Montfort, sp., very rare.  
*Polymorphina communis*, d'Orbigny, very rare.  
 ——— *amygdaloides*, Reuss, rare.  
 ——— *cylindroides*, Roemer, very rare.  
 ——— *gibba*, d'Orbigny, (var *æqualis*.)  
*Uvigerina angulosa*, Williamson, very rare.  
*Globigerina cretacea*, d'Orbigny, very rare.  
*Sphæroidina bulloides*, d'Orbigny, very rare.  
*Truncatulina lobatula*, Walker and Jacob, sp., common.  
 ——— *dutemplei*, d'Orbigny, sp., very rare.  
*Anomalina grosserugosa*, Gumbel, sp., very rare.  
*Planorbulina mediterranea*, var *costellata*, Terquem, very rare.  
 ——— *larvata*, Parker and Jones, very rare.  
*Discorbina vesicularis*, Lamarek, common.  
 ——— (trochidiformis, Lamarek, very common.)  
 ——— *parisiensis*, d'Orbigny, sp., common.  
*Pulvinulina auricula*, Fichtel and Moll., sp., rare.  
 ——— *melchioriana*, d'Orbigny, sp., very rare.  
*Rotalia beccarii*, L., sp., very common.  
 ——— *soldanii*, d'Orbigny, sp., rare.  
 ——— *calcar*, d'Orbigny, sp., common.  
*Nonionina scapha*, Fichtel and Moll., sp., very rare.  
 ——— *depressula*, Walker and Jacob, sp., very common.  
 ——— *umbilicatulina*, Montagu, sp., rare.  
*Polystomella erispa*, L., sp., very common.  
 ——— *striatopunctata*, Fichtel and Moll., sp., very common.  
 { *Nummulina variolaria*, Lamarek, very common.  
 { ——— *elegans*, Sowerby, rare.  
 { ——— *laevigata*, Lamarek, not abundant.

The bracketted forms are certainly derived from older beds.

Amongst the Foraminifera determined for me by Mr. F. Chapman, are some not included in the foregoing list, viz :—*Cornuspira foliacea*, Phil., *Discorbina orbicularis*, Terq., and *D. rosacea*, d'Orbigny. *D. orbicularis* is another of the southern organisms unknown to the British fauna.

I may add also *Miliolina triangularis*, and *Triloculina tricarinata*.

#### Actinozoa.

*Sphenotrochus selseyensis*, A. Bell.

#### Protozoa.

*Clione celata*.

#### Hydrozoa.

*Corallina officinalis*.

*Sertularia pumila*.

#### Algæ.

*Cladophora lanosa*.

**Plantæ.**

Ranunculus repens.

Rubus fruticosus.

Rhinanthus cristagalli.

The mollusca mentioned below are amongst those which are not represented in the recent British Seas.

|                         |                        |                           |
|-------------------------|------------------------|---------------------------|
| Dischides bifissum.     | Cithna minima.         | Pecten aratus.            |
| Dentalium dentalis.     | Hydrobia compactilis.  | „ flexuosus.              |
| „ candidum.             | Barleeia cingulata.    | „ hyalinus.               |
| „ panormum.             | Turritella incrassata. | „ scabriusculus.          |
| Chiton siculus.         | Mesalia brevisalis.    | Pecten andoninii.         |
| Fissurella costaria.    | Odostomia elongata.    | „ proteus.                |
| Solariella acutangula.  | Chemitza formosa.      | Kellia ambigua.           |
| „ approximata.          | „ gracilis.            | Cardium papillosum.       |
| Trochus turgidulus.     | Scalara foliacea.      | „ inæqualis.              |
| Cyclostrema elegantula. | „ sp.                  | „ strigilliferum.         |
| Rissoa cimex.           | Adeorbis supranitida   | Astarte pygmæa.           |
| „ montagui.             | Nesæa lineolata.       | Cardita trapezia.         |
| „ deliciosa.            | Pleurotoma bertrandi.  | „ chamæformis.            |
| „ scutula.              | Ostrea lusitanica.     | Lucinopsis Lajorikaireana |
| „ bicarinata.           | „ cochlear.            | Lutraria rugosa.          |
| „ multistriata.         |                        | Tapes perovalis.          |

In preparing the above lists I have been much indebted to Messrs. Smith-Woodward and Newton (Pisces), T. Scott (Ostracoda), E. R. Vine (Polyzoa), Millett and Chapman (Foraminifera); and to Messrs. Etheridge and Gregory for general assistance.

A careful examination of the foregoing lists makes it at once evident that we are in the presence of a fauna which has no equivalent in the British post-tertiaries, not only because of its purely southern aspect, but for the number of species in common with those of the older and undisturbed Pliocene deposits of the east coasts, including some of which the present habitat is unknown. The proportion of Mollusca common to Selsey and the Craggs (marked x.) is nearly 45%, of the Polyzoa nearly 90%.

The question at once arises, that deposits so alike in their general facies, yet so widely separated in time and space, must have had some common source of origin, possibly on the lines indicated in the following notes.

In a valuable preliminary study of the fossil shells of the Touraine Faluns, M. M. Dollfus and Dautzenberg point out that the Miocene seas of Europe occupied three areas or basins, certain species being common to all. The Saxon covering North Germany, Belgium, and Holland; the Atlantic, Touraine and West France; and the Mediterranean, South Europe.

In the north the onward progression from the Miocene to the Pliocenes is not marked by any violent fluctuation, but by a gradual extension westward of the Diestien Seas into

Britain, and the accumulation of the Coralline Crag and Passage beds of Walton-on-the-Naze, the fauna maintaining its Miocene or southern aspect, *northern shells being entirely absent*. In the next stage we have considerable alterations, but also a large influx of northern species, these ultimately superseding the southern fauna.

On the western side the Atlantic Miocene seas had their Pliocene development in the Cotentin and La Manche departments of N. France. In their joint memoir upon the Cretaceous and Tertiary deposits of these places, M. M. Viellard and Dollfus separate the Pliocenes into two—the Terebratula conglomerate, near St. George's Bohon (also mentioned by Sir Charles Lyell, and Mr. Godwin-Austen), and the Marnes à Nassa, at Le Bosq. The conglomerate is related through *Arca diluvii* and *Terebratula ampulla*, or *grandis*, to the Diestien Lenham beds; and the Le Bosq deposit to the Coralline Crag by its general facies, and the many species in common. Of 43 species determined from this horizon by Messrs. Deslongschamps, Hebert and myself, 28 are known in the Suffolk Pliocenes and it is in this direction, notwithstanding the immense lapse of time involved, that I look for the cause or presence of the southern fauna in the Selsey beds.

It may well be that the extension of the Pliocene sea into the before-mentioned St. Erth Valley, coincided with the basement beds of Walton-on-the-Naze, for in both places the faunal evidence is against the presumption that they were open to northern influence, the necessary physical changes to this end, although probably in motion, not being sufficiently advanced. When they were so, we find on either side of the country that the northern fauna began to make itself felt, the southern fauna gradually dying out as the northern took root. This we see not only in the later Pliocenes of East England, but also in the Wexford gravels, which I have assumed elsewhere to be pre-glacial, and in the drifts of Killiney Bay, Ireland, and the fossiliferous beds in the Isle of Man, in all which places Pliocene or southern shells are present.

That some line of communication was open between the northern and mediterranean Seas is proved by the presence of

such boreal forms as *Pecten islandicus*, *Lima excarata*, *Saxicava Norvegica* and others in the Sicilian Upper Tertiaries : and the deep sea dredgings in the Bay of Biscay, and off the South of Ireland, offer conclusive evidence of areas still existing in which the faunas of the north and south co-exist. Such a line of communication would cross France between Bordeaux and Narbonne, the Selsey Sea being separated from it by the as yet unbroken land westward.

The large erratic blocks of stone scattered along the shore are often of considerable size (one now hidden in the advanced shingle near Pagham on the opposite side of the Selsey Peninsula measuring 28 feet round) and of great interest, and including a siliceous breccia, crystalline limestones, grey and red granites, syenites, slates, mica schist, conglomerates and other rocks whose place of origin has not been definitely recognised ; and in various instances this seemed to indicate to Mr. Goodwin-Austen that they had been derived from rocks formerly occupying the bed of the English Channel.

After a long and careful examination of the surroundings, I am unable to accept Mr. Goodwin-Austen's view that the association of these rocks with the yellow clay mentioned in the earlier part of this paper is otherwise than accidental, as they occur in many places where the clay is absent, and the view I have been inclined to adopt is that they were not deposited till a much later date, and that they mean a difference of 20 degrees of latitude between the temperature prevailing at the time of the formation of the mud deposit, and that equal to the production of ice sufficiently strong to bear their weight, and the distance and direction from which they must have come sufficiently testify that wide and spreading changes had taken place before such movement became practicable.

Of the deposits that were presumably laid down during this interval there is no trace either at Selsey or eastwards, but the whole of the foregoing deposits show great denudation and erosion.

The Selsey fauna may be collated with the insects of the Lexden peat described by the Rev. O. Fisher which are altogether of trans-Pyrenean types, and, like the Selsey organisms, indicate a much warmer climate than now prevails.

That southern and western influences were in action elsewhere soon after, is shown by the fauna of the Severn drifts, the West Indian Olive (*O. jaspidea*, apparently, from Strickland's sketch in Newer Pliocene Geology), and a large *Bulla* in the Worcester gravels, and the presence of *Cardium aculeatum*, *C. tuberculatum*, *Macra glauca*, *Cytherea chione*, and other species so far north as Leyland, near Preston, Lancashire, which have their nearest chief habitat in the extreme west of England and the Channel Islands indicating this.

Reasoning from the fauna, the further opening of the channel was subsequent to that of the Severn straits as shewn by the contents of the raised beaches in Torbay, and on Portland Bill, and these latter deposits I take to represent the deposits now removed, *accumulated between* the formation of the earlier "mud deposit" and the erratic blocks so often referred to, the fauna being equivalent to the intermediate temperature, or as put by Dr. Gwyn-Jeffreys is "rather southern than northern but not containing species peculiar to either area." My own researches in these beds and the species subsequently added to the lists upon which those remarks were based, confirm the statement.

It is a little noticeable as a coincidence that while the lowest strata in Kent's Hole, Torquay, yield *only* terrestrial relics, the higher cave earth has produced introduced shells and other debris of marine origin.

The lists of species given from Torbay and Portland Bill are compiled from various sources but have in nearly every instance been verified from my own observations.

|                                       | Torbay. | Portland. |                                     | Torbay. | Portland. |
|---------------------------------------|---------|-----------|-------------------------------------|---------|-----------|
| <i>Adeorbis subearinata</i> . . . . . | x       | —         | <i>Littorina obtusata</i> . . . . . | x       | x         |
| <i>Aporrhais pes pelicani</i> . . . . | x       | —         | „ <i>rudis</i> . . . . .            | x       | x         |
| <i>Buccinum undatum</i> . . . . .     | x       | x         | <i>Murex erinaceus</i> . . . . .    | x       | x         |
| <i>Cerithium reticulatum</i> . . . .  | x       | —         | <i>Nassa incrassata</i> . . . . .   | x       | x         |
| <i>Cylichna cylindracea</i> . . . . . | x       | —         | „ <i>reticulata</i> . . . . .       | x       | —         |
| <i>Defrancia linearis</i> . . . . .   | —       | x         | <i>Natica alderi</i> . . . . .      | x       | —         |
| <i>Fusus gracilis</i> . . . . .       | x       | —         | <i>Patella vulgata</i> . . . . .    | x       | x         |
| „ <i>jeffreysianus</i> . . . . .      | x       | —         | <i>Pleurotoma brachystoma</i> ..    | x       | —         |
| <i>Helcion pellucidum</i> . . . . .   | x       | x         | „ <i>nebula</i> . . . . .           | x       | —         |
| <i>Lacuna puteolus</i> . . . . .      | x       | x         | „ <i>turricula</i> . . . . .        | x       | —         |
| <i>Littorina littorea</i> . . . . .   | x       | x         | „ <i>striolata</i> . . . . .        | x       | —         |

|                                  | Torbay. | Portland. |                                    | Torbay. | Portland. |
|----------------------------------|---------|-----------|------------------------------------|---------|-----------|
| <i>Purpura lapillus</i> .....    | x       | x         | <i>Cyamium minutum</i> .....       | —       | x         |
| <i>Rissoa parva</i> .....        | —       | x         | <i>Cyprina islandica</i> .....     | x       | —         |
| „ <i>interrupta</i> .....        | —       | x         | <i>Lutraria elliptica</i> .....    | x       | —         |
| „ <i>striata</i> .....           | —       | x         | <i>Mactra subtruncata</i> .....    | x       | —         |
| „ <i>subcylindrata</i> .....     | —       | x         | <i>Mya arenaria</i> .....          | x       | —         |
| <i>Scalaria turtoni</i> .....    | x       | —         | <i>Modiola modiolus</i> .....      | x       | —         |
| <i>Skenea planorbis</i> .....    | —       | x         | <i>Mytilus edulis</i> .....        | x       | x         |
| <i>Tectura virgineus</i> .....   | x       | x         | „ <i>phaseolinus</i> .....         | —       | x         |
| <i>Trochus cinerarius</i> .....  | —       | x         | <i>Nucula nucleus</i> .....        | x       | —         |
| „ <i>helicinus</i> .....         | —       | x         | <i>Ostrea edulis</i> .....         | x       | x         |
| „ <i>umbilicatus</i> .....       | —       | x         | <i>Pecten maximus</i> .....        | x       | —         |
| „ <i>zizyphinus</i> .....        | x       | —         | „ <i>varius</i> .....              | x       | —         |
| <i>Tophon truncatus</i> .....    | x       | x         | <i>Pinna pectinata</i> .....       | x       | —         |
| <i>Turritella terebra</i> .....  | x       | —         | <i>Saxicava rugosa</i> .....       | x       | x         |
| <i>Utriculus truncatus</i> ..... | —       | x         | <i>Solen vagina</i> .....          | x       | —         |
| <i>Helix nemoralis</i> .....     | —       | x         | <i>Tapes decussatus</i> .....      | x       | —         |
| <i>Anomia ephippium</i> .....    | —       | x         | <i>Tellina balthica</i> .....      | x       | —         |
| <i>Artemis exoleta</i> .....     | x       | —         | <i>Venus fasciata</i> .....        | x       | —         |
| <i>Astarte sulcata</i> .....     | x       | —         | „ <i>gallina</i> .....             | x       | —         |
| <i>Cardium edule</i> .....       | x       | —         | <i>Venerupis irus</i> .....        | x       | —         |
| „ <i>echinatum</i> .....         | x       | —         | <i>Modiolaria marmorata</i> ....   | —       | x         |
| „ <i>norvegicum</i> .....        | x       | —         | <i>Cancer pagurus</i> .....        | —       |           |
| „ <i>tuberculatum</i> ....       | x       | —         | <i>Corallina officinalis</i> ..... | —       |           |

The extensive gravels and associated beaches of Hants and Sussex do not pass eastwards of the chalk, but implement-bearing gravels are present on the cliff near the Reculvers, and I have obtained one from the gravels on the top of the Sheppy Clays near the Royal Oak, Minster. Near Warden Point, as described by Professor Sedgwick (Proc. Geol. Soc., Lond., v. 1, p. 409), a marine deposit 140 feet above the sea formerly existed with a limited fauna. Another may still be seen resting in a hollow in the summit of the chalk in Pegwell Bay. From the brickyard at this place I have obtained 16 species, viz. :—

*Buccinum undatum.*  
*Fusus antiquus.*  
*Hydrobia ulvæ.*  
*Littorina littorea.*  
 „ *obtusata.*  
*Murex erinaceus.*  
*Patella vulgata.*  
 „ *var.*

*Cardium edule.*  
*Donax vittatus.*  
*Mytilus edulis.*  
*Ostrea edulis.*  
*Scrobicularia piperata.*  
*Syndosmya alba.*  
 „ *tenuis.*  
*Tellina balthica.*  
 „ *tenuis.*

With these are associated, especially in the cliff face, a number of land shells that may have been introduced by a small stream, as amongst them occur *Pisidium*, *Planorbis* and young *Paludina*.

*Achatina acicula.*  
*Bulimus obscurus.*  
*Clausilia nigricans.*  
*Helix aspersa.*  
 „ *cantiana.*  
 „ *caperata.*  
 „ *hispida.*  
 „ *nemoralis.*  
 „ *pulchella.*  
 „ *rotundata.*  
 „ *virgata.*

*H. (Zonites) alliarius.*  
 „ *cellarius.*  
 „ *crystallinus.*  
 „ *nitidulus.*  
*Pupa muscorum.*  
*Zua lubrica.*  
*Paludina*  
*Planorbis spirorbis.*  
*Pisidium nitidum.*  
*Limax cinereus.*

There is no evidence to shew when the English Channel finally opened up, beyond the suggestion of Mr. Godwin-Austen, that if the Sangatte beds and the Combe rock are of the same period, it must have taken place after their formation. It may be worth noting that the flint implement found at Portslade, 15 feet deep in the Combe rock, is of a more modern type than those in the gravels, but less so than the tool of undoubtedly Cissbury manufacture now in the Brighton Museum and said to be from Selsey. Very little change has ensued in the relations of land to water since this event, beyond a slight elevation as seen in many places on the coast. One such occurs upon the banks of the Hayle River, Cornwall, from which 23 species were obtained. Its position at the base of, and covered by, the blown sands indicates its accumulation before the forming of the dunes probably on the upper margin of a wind swept beach.

*Buccinum undatum.*  
*Littorina littorea.*  
 „ *obtusata.*  
 „ *rudis.*  
*Patella vulgata.*  
*Purpura lapillus.*  
*Artemis lineta.*  
*Cardium edule.*  
 „ *echinatum.*  
 „ *tuberculatum.*  
 „ *norvegicum.*  
*Cytherea chione.*

*Lutraria oblonga.*  
*Mactra solida.*  
*Mytilus incurvatus.*  
 „ *modiolus.*  
*Ostrea edulis.*  
*Pecten maximus.*  
*Pectunculus glycymeris.*  
*Venus fasciata.*  
 „ *gallina.*  
 „ *verrucosa.*  
*(Tapes) virginea.*

The richness of the sandhills both in Cornwall and in the Roundstone Bay, County Galway, is well known. The presence in each locality of certain forms of the common *Helix nemoralis* of a size and solidity now unknown, implies different conditions to those now prevailing.

I have found marine shells on the right bank of the Fowey River, Cornwall, 3 miles from the sea, 5-6 feet above H.W. mark, and at Pegwell Bay, Kent, where the Thanet Sands slope to the shore, some low mud cliffs are now being eaten

away by the sea. These contain seams of *Hydrobia* at their base, the upper portion being almost entirely made of the common *Cardium* and *Tellina balthica*.

I may notice, in conclusion, a fauna obtained near Sandwich, in Kent, some little distance inland from a deposit which I have not yet seen. Amongst the shells I find 35 species, including some deeper water forms than usually occur in shore deposits. These were apparently accumulated in a sand bank or eddy and are comparatively recent.

|                                 |                                   |
|---------------------------------|-----------------------------------|
| <i>Buccinum undatum</i> .       | <i>Donax vittatus</i> .           |
| <i>Fusus antiquus</i> .         | <i>Macra stultorum</i> .          |
| <i>Hydrobia subumbilicata</i> . | <i>Mya arenaria</i> .             |
| „ <i>ulvæ</i> .                 | „ <i>truncata</i> .               |
| <i>Murex erinaceus</i> .        | <i>Mytilus edulis</i> .           |
| * <i>Nassa incrassata</i> .     | <i>Nucula nucleus</i> .           |
| * <i>Natica catena</i> .        | <i>Ostrea edulis</i> .            |
| <i>Patella vulgata</i> .        | <i>Pecten varius</i> .            |
| <i>Purpura lapillus</i> .       | „ <i>opercularis</i> .            |
| * <i>Scalaria communis</i> .    | <i>Pectunculus glycymeris</i> .   |
| <i>Trochus cinerarius</i> .     | * <i>Scrobicularia piperata</i> . |
| „ <i>magus</i> .                | * <i>Solen ensis</i> .            |
| „ <i>zizyphinus</i> .           | „ <i>marginatus</i> .             |
| <i>Turritella terebra</i> .     | <i>Syndosmya alba</i> .           |
| <i>Anomia ephippium</i> .       | „ <i>tenuis</i> .                 |
| <i>Cardium edule</i> .          | <i>Tellina balthica</i> .         |
| „ <i>norvegicum</i> .           | „ <i>tenuis</i> .                 |
| „ <i>tuberculatum</i> .         |                                   |

**Notes** on some of the Selsey fossils, and description of the rarer, or new species :—

\*\* *Ostrea lusitanica*.—A long and narrow form of Oyster of which only a few examples have been obtained, the common *O. edulis* being the most abundant.

*Pecten hyalinus*, Poli.—A single valve only. Unfortunately lost.

†† „ *polymorphus*, Brown.—Comprises two species, *P. flexuosus*, Poli, and *P. porteus*, Sow.

„ *testae*, Bivona.—A small but well marked example.

„ *scabriusculus*, A. Bell.—N. sp. A small species, pure white, not unlike at first sight the young of *P. varius*, from which it differs in the sculpture between the rays, and the shape of the auricles. Rays 26, sparsely scaled intervals crossed by raised imbricated scales, regularly placed auricles rayed, umbo pointed. Depth 4 m.m., breadth 2 m.m.

*Kellia ambigua*, Nyst.—Crag. Moll. II., tab. xii. fig. 2. Not uncommon.

*Cardita chamaeformis*, Leathes.—Crag Moll. II. tab. xv., fig. 3. Two specimens; these, although small, come nearer to the crag species than to any other, so far as can be ascertained. In size they are nearer *C. corbis*, Phil., but differ in sculpture and shape.

*Cardita trapezia*.—Requires verification. I fear one of the small Bracklesham shells may have been taken for it. I have, however, obtained the fry of *C. trapezia* in the Post Glacial Garvel Park beds, on the Clyde.

*Cardium papillosum*, Poli.—Jeff. Brit. Con. v., pl. xxv., fig. 1. Rather scarce, but well marked in the characteristic nodules or papillæ.

*Cardium inæqualis*, A. Bell.—This species is more oblique and unequilateral than *C. papillosum*, and differs on the posterior margin from *C. strigilliferum*. It is ornamented with 21—22 flattened costæ, is sparsely tuberculated, deeply punctured in the intervals. Test somewhat oblong, anterior side short and rounded, expanded and dilated above, the costæ on the posterior margin are channelled or tubular.

*Cardium strigilliferum*, S. V. Wood.—Crag Moll. II., tab. xiii., fig. 5. One specimen so near to this form as to be practically undistinguishable.

*Tapes perovalis*, S. V. Wood.—Crag Moll. II., tab. xix. fig. 7. One fine example which cannot be distinguished from the figure in the Crag Mollusca, or the type shell in the British Museum.

*Lucinopsis Lajonkaireana*, Payr.—Crag Moll. II., tab. xi., fig. 14. One pair encrusted with a *Lepralia* in the Royal School of Mines, London.

\*\* *Donax vittatus*, var. *nitida*, Jeffr. —A very truncate of shell agreeing with Jeffrey's description.

\* *Lutraria rugosa*, Chem.—Several examples known; a large and handsome species.

*Dentalium panormum*, Chem.—A very small but perfect example. Differs from *D. dentalis* in the greater number, fineness and closeness of the ribs.

*Dentalium candidum*, Jeffreys.—A fragment only; but identical in number of ribs and close set ridges crossing the intervals between with Jeffrey's figure. Proc. Zool. Soc., Lond., 1882, p. 658, pl. xlix., fig. 2.

*Chiton siculus*, Gray.—One of the commonest of the several Chitons found at Selsey. May be known by the deep grooves on the surface.

*Cyclostrema elegantula*, Phillippi.—En. Moll. Soc., ii. p. 146, pl. xxv. fig. 3. A very fine example of this species has occurred to me in the Selsey Silt. I cannot separate it from the figure which, however, does not show the apparent ridges or strong lines of growth on the upper part of the whorls, which are only perceptible from above, of which Phillippi does not give a view.

*Solariella acutangula*, A. Bell.—Shell compressed both above and below. Spire but slightly elevated, apex immersed, whorls 4—5, enlarging rapidly downwards with 6—7 concentric ridges of unequal thickness above the periphery, and 5 below the lowest, situated within a large open umbilicus. Suture, a deep open channel. The mouth is sharply angulated by the spreading

peripheral ridge pillar slightly covered by enamel forming an acute angle at junction with outer lip. Nacreous, colour chestnut brown, blotches. The inter-ridgial spaces are crossed by very distinct fine camellar lines of growth. Height 2 m., breadth 4 m m.

*Solariella approximata*, A. Bell.—Shell small, spire depressed whorls 3—4 rounded at side, flattened above with 3—4 sharply moulded circular ridges, the peripheral one strongest. Of the 3—4 ridges below, the lowest 2 are granulated by strong lines of growth. Suture distinct. Umbilicus deep and open pillar and bare of outer lip obtusely angulated. Mouth obliquely stromboidal. Nacreous, much resembles a small *Euomphalus pentangulatus*. Height 1.25 m.m., breadth 2 m.m.

This and the preceding species belong to a group of Trochi characterised by the flatness of the top of the whorls, of which *Trochus cinctus*, Phil., *Margarita maculata*, S. V. Wood, and *Trochus amabilis*, Jeffreys, are the most pronounced forms. These, according to Dr. Jeffreys, are one and the same species. *S. approximata* closely resembles the young of *M. maculata* for which I took it at first. It differs as far as I can see, judging by the few examples I have met with, from the latter shell by the greater depression of the spire and the angularity of the mouth.

*Cithna minima*, A. Bell.—Shell a short conic oval. Whorls 4, angulated on the body whorl which comprises the greater part of the shell. Preceding whorls short, apex depressed; suture deep, mouth almost circular, base expanded, pillar lip curved, canal or chink long and narrow.

*Hydrobia compactilis*, A. Bell.—A smooth white solid shell; whorls 5—6. Apex blunt, two next whorls round and swollen, remainder turned, mouth roundly oval, outer lip thickened outside, inner lip thin slight, barely continuous; base slightly effuse, imperforate.

Somewhat resembles *H. compacta*, Jeffreys, but differs in several points from that species.

*Rissoa deliciosa*, Jeffreys.—Proc. Zool. Soc., Lond., 1884, p. 121, pl. ix., fig. 7. The only Selsey example cannot be separated from the above species with which it agrees in figure and description.

*Rissoa bicarinata*, A. Bell.—Shell an elongated cone with bluntly pointed apex. Whorls 6, body whorl equalling all the others, flatly convex, suture deep, body whorl sharply angulated at the periphery, and less so below or on the shoulder producing a squarish outline, peristome continuous, outer lip strengthened by exterior rib, inner lip thin, chink small.

*Rissoa scutula*, A. Bell.—Shell conic, apex blunt, whorls 6—7, convex ornamented with close set long oval scute like markings depressed in the centre, the whole resembling the links of a chain, these do not pass below the periphery of body whorl. Outer lip rounded, thickened by an exterior varix, peristome continuous, inner lip slight, pillar nearly straight. Chink distinct but small; base effuse. Length 3 m.m., breadth 1 m.m.

*Rissoa multistriata*, A. Bell.—Shell a short cone tapering rapidly, apex blunt, nucleus minute, whorls 5 convex, suture well defined, body of shell covered with close set striae or ridges passing in the upper part of the whorls over some swollen costae placed rather wide apart, mouth oval, inner and outer lips thin umbilicus minute but deep. Length 1.25 m.m., breadth 1 m.m.

*Rissoa Montagu*, Payr.—One example only, but very characteristically marked. It is not uncommon in the pliocene beds at St. Erth, Cornwall.

*Barleeia?* *cingulata*, A. Bell.—Shell a solid cone, spire acute, apex blunt, whorls 6—7 rather flat, smooth, suture deep, narrowly channelled, mouth oval dilated and patulated below inner lip, spread over pillar. Colour brown with white cincture near periphery. Length  $4\frac{1}{2}$  m.m., breadth 2 m.m.

The above shell is named with some doubt. It does not agree with any species of *Barleeia* that I am acquainted with, but comes very close to some of them. Its chief characters appear to be the flatness of the whorls, and the patuliform mouth. It may be *Turbo unifasciata* of Montagu, but I think not.

*Odostomia elongata*, A. Bell.—Long, smooth white acicular, apex pointed, nucleus blunt, whorls 6—7 flatly convex, suture deep, aperture narrowly pear shaped angular above, expanding below. Outer lip straight, inner lip prominent in front of moderate umbilical chink carrying about midway a strong fold or plait. Length 4 m.m., breadth 1.25 m.m.

Differs from *O. truncatula* in the shape of the whorl, and columellar tooth.

*Chemnitzia gracilis*, Phil.—En. Moll. Sic. II., p. 137, pl. xxiv., fig. 11. *Od. delicata*, Monterosato, which should supersede Philippis' name, as it is neither *Turbo gracilis*, Brocchi, nor *Chemnitzia gracilis* of Koninek, both older names.

*Chemnitzia formosa*, Jeffreys.—A fragment unfortunately consisting of 2 whorls only; is of considerable interest. The sculpture is very marked, and so closely resembles that of the shell figured in Forbes and Hanley, Brit. Moll., V. iv, pl. xciii., fig. 5, that I have no hesitation in correlating the fragment with the figure.

There is some misunderstanding about the habitat of the recent shell. Jeffreys obtained it from a dealer who stated it was found at Shellness, Kent. F. and H. also give Jeffreys as finding it at Oxwich, and Mr. Barlee in Bantry Bay. Jeffreys on the other hand, Brit. Con., v. ix., p. 164, remarks "that I am not satisfied about the origin of the specimen," the other species he referred to it being *O. rufa*, var. *fulvocincta*.

Its turning up at Selsey may therefore suggest that it is an inhabitant of the Atlantic whose whereabouts is not known at present. It does not agree with any of the deep sea forms described by Jeffreys.

*Nesaea lineolata*, Tiberi.—Journ. Conchgl., 1868, pl. v., fig. v. This is a scarce Mediterranean form of *Lachesis* and is at present only known from one or two localities in the South of Italy. It is the *Lachesis minima* of my earlier list of Selsey species.

*Sphenotrochus Selseyensis*, A. Bell.—Broad above, diminishing to a pointed base, margin of calice, arched in the longest direction, calice oval, septa strong, columella large, costae moderately thick, thickest nearer the sides, straight or nearly so.

Differs from *S. intermedia* by its narrow and pointed base, general contour, and fewer septa.

*Micropora regularis*, d'Orb — Terr. Cret., p. 188, Atlas pl. 600—601.

“This is unlike any British form of *Micropora* known to me. It more closely resembles both in general outline and arrangement of cells the *Vincularia regularis*, d'Orb.”—Note by G. R. Vine, Esq.

*Diastopora regularis?* d'Orb.

“This is a much more delicate example than one described by me from Red Chalk. It may very well bear a varietal name. It is a beautiful little species and very distinct.”—Note by G. R. Vine, Esq. I propose the name *Selseyensis* from the locality whence I obtained it.

NOTE.—Since the foregoing was written, Mr. Clement Reid, F.G.S., of H.M. Geological Survey, has obligingly favoured me with a copy of a paper recently read by him at a meeting of the Geol. Soc., Lond., on the same subject. The chief differences between us appear to be the position and age of the erratics.

The suggestion of Mr. Reid that the size of the large *Pholas crispata* is indicative of Arctic condition is hardly tenable, because strictly speaking it is not an Arctic shell so much as a boreal form, and the nearest in point of size to the largest Selsey example recorded, viz.—6 inches in breadth, are those from the estuarine clays of late origin in the Belfast estuary, where specimens of 4 and 4½ inches in breadth are not uncommon: and the northern cirripede, *B. porcatus*, I obtained in association with, in fact affixed to, the large *Tapes decussatus* so characteristic of the mud deposit.

There is no doubt that the erratics are very widely spread beyond the area of the Selsey mud, but this does not prove their precedence in time any more than does the occurrence of a single block in the clay (the “hard mud” bed of my paper) examined by Mr. Reid.

Had the erratics or any of them been found in situ *below* the hard Pleistocene clay, the claim in favour of “this problematic earlier glaciation” would have been very much strengthened. As it is, such claim seems to rest upon the fact that as these blocks or erratics extend over the adjacent earlier Eocene clays they must therefore of necessity be older than the mud deposit itself, a conclusion I certainly cannot agree with, as being against the weight of evidence, all the conditions pointing to a much later period of distribution and the erratics deposited on a greatly eroded and denuded surface as suggested in my text.

The non-marine fauna and flora recorded by Mr. Reid from the ancient river bed at West Wittering is a very valuable addition to our knowledge of the life of the period in question. To make the lists I have given more complete, Mr. Reid has kindly permitted me to add his lists, as given in his paper, to my own.

If any value may be placed upon the facies of a fauna as indicating the temperature of the age in which it was accumulated, it may be that the older portion of the Thames gravels, the Lexden peat, the Fluvatile gravels about Cambridge should be considered as coeval with the Selsey mud, all these having a fauna more consonant with the presence of a warmer climate than afterwards prevailed.

List of Mollusca, Flowering plants, and Mosses obtained by G. C. Reid, Esq., F.G.S., at West Wittering, near Selsey. (Inserted by permission).

|                       |                      |
|-----------------------|----------------------|
| Card. edule.          | Velletia lacustris.  |
| Scrob. piperata.      | Hydrobia marginata.  |
| Tell. balthica.       | „ similis.           |
| Corbicula fluminalis. | „ ulvæ.              |
| Sphærium corneum.     | „ ventrosa.          |
| Pisidium amnicum.     | Limax agrestis.      |
| „ pusillum.           | Succinea elegans.    |
| Bithynia tentaculata. | „ oblonga.           |
| Valvata piscinalis.   | Zonites fulvus.      |
| „ cristata.           | Helix hispida.       |
| Planorbis carinatus.  | „ nemoralis.         |
| „ complanatus.        | „ pulchella.         |
| „ contortus.          | „ rotundata.         |
| „ nautileus.          | „ rupestris.         |
| „ nitidus.            | Zua lubrica.         |
| „ spirorbis.          | Pupa muscorum.       |
| Limnæa auricularius.  | Vertigo edentula.    |
| „ palustris.          | Clausilia biplicata. |
| „ peregra.            | Carychium nimum.     |
| Ancylus fluviatilis.  |                      |

## Flowering Plants.

|                             |         |                             |         |
|-----------------------------|---------|-----------------------------|---------|
| Thalictrum flavum. ....     | L.      | Cnicus lanceolatus.....     | Hoffm.  |
| Ranunculus aquatilis.....   | L.      | Lapsana communis .....      | L.      |
| „ sceleratus ....           | L.      | Menyanthes trifoliata ....  | L.      |
| „ lingua. ....              | L.      | Lycopus europaeus .....     | L.      |
| „ reptans .....             | L.      | Ajuga reptans.....          | L.      |
| „ bulbosus ....             | L.      | Atriplex patula .....       | L.      |
| „ sardous .....             | Crantz. | Polygonum persicaria ....   | L.      |
| „ pauciflorus....           | L.      | Rumex conglomeratus ....    | Murr.   |
| Caltha palustris .....      | L.      | „ obtusifolius .....        | L.      |
| Nuphar luteum .....         | Sm.     | Mercurialis perennis .....  | L.      |
| Viola sp. ....              |         | Corylus avellana .....      | L.      |
| Silene maritima ....        | With.   | Ceratophyllum demersum ..   | L.      |
| Stellaria media .....       | Cyr.    | Sparganium ramosum ....     | Curtis. |
| Prunus cerasus, or avium .. | L.      | Ruppia maritima .....       | L.      |
| Spirœa ulmaria .....        | L.      | Zannichellia palustris .... | L.      |
| Rubus fruticosus .....      | L.      | Elæocharis palustris .....  | R. Br.  |
| Poterium officinale.....    | Hook.   | Scirpus pauciflorus .....   | Lightf. |
| Rosa canina .....           | L.      | „ lacustris.....            | L.      |
| Hippuris vulgaris .....     | L.      | Carex disticha.....         | Huds.   |
| Myriophyllum spicatum ..    | L.      | „ riparia .....             | Curtis. |
| Hydrocotyle vulgaris ....   | L.      |                             |         |
| Oenanthe crocata .....      | L.      |                             |         |
| „ phellandrium....          | L.      |                             |         |
| Angelica sylvestris.....    | L.      |                             |         |
| Cornus sanguinea .....      | L.      |                             |         |
| Sambucus nigra.....         | L.      |                             |         |
| Viburnum opulus .....       | L.      |                             |         |
| Scabiosa succisa.....       | L.      |                             |         |
| Eupatorium cannabinum ..    | L.      |                             |         |

### Mosses.

|                          |
|--------------------------|
| Neckeria complanata.     |
| *Homalothecium sericeum. |
| *Eurhynchium prœlongum.  |
| „ speciosum.             |
| *Hypnum cupressiforme.   |
| „ fluitans.              |
| „ schreberi.             |
| „ aduncum.               |

\*Also at Selsey with *Brachythecium populum* and *Leueodon sciuroides*.

NOTE.—It was not until the writer had exhausted all the means of reference to his hand, including the work of Semper, Beyrich, Philippi, Nyst, S. V. Wood, Forbes and Hanley, Jeffreys, Montrosato and others, that he found it desirable to describe so many fresh species. The fact that the Selsey deposits have yielded two or more species that were unknown to science till the result of the deep sea dredging carried on by H.M.S. Lightning and Porcupine, is some justification for the course adopted. Should it prove, unfortunately, that some unnecessary synonymms have been brought forward, it has not been done intentionally. A.B.

"Hampshire Philosophical Society's Report, 1892"  
to face p. 78.

## THE FORAMINIFERA OF A POST-TERTIARY DEPOSIT IN SUSSEX.

BY F. W. MILLETT.

THE material submitted for examination consisted of about three ounces of a somewhat coarse sand, containing many minute mollusca and foraminifera, together with a few ostracoda and many fragments of echinodermata and polyzoa. There were also present numerous glauconitic internal casts of foraminifera, and many of the shells contained iron pyrites.

When placed in a sieve of eighty threads to the inch, about half-a-dram of fine material passed through, whilst the grains which remained behind were almost uniform in size, few of them exceeding the one-tenth of an inch in diameter. In this coarser portion the foraminifera were very abundant, but much weathered and rolled, and consisted principally of the common forms of the eocene beds of Hampshire, viz. — *Nummulina variolaria*, *Alveolina sabulosa* and *Discorbina trochidiformis*.

In the finer portion there was much greater variety, and nearly all the specimens were in good condition, many of them being recent.

It is evident that the deposit contains foraminifera derived from the eocene and possibly from the cretaceous formations, mixed with a large number of recent specimens, the remainder being composed of tertiary forms, to which, under the circumstances, it would be difficult to assign the exact horizon. Some of the species are represented by specimens both recent and fossil.

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N.B.—This note, necessary to explain the incongruous concurrence of species, was omitted from Mr. BELL's communication to the Society.





## EXPLANATION OF PLATE I.

|            |                                                                            |    |    |                        |                |
|------------|----------------------------------------------------------------------------|----|----|------------------------|----------------|
| 1.         | <i>Ostrea lusitanica</i> , ( $\frac{1}{2}$ natural size),                  | .. | .. | "Mud-deposit," Selsey. | (York Museum). |
| 2.         | <i>Pecten scabriusculus</i> , A. Bell, ( $\times 5$ )                      | .. | .. | "                      | "              |
| 3.         | <i>P. polymorphus</i> , Bronn                                              | .. | .. | "                      | "              |
| 4.         | <i>P. testæ</i> , Biv, ( $\times 4$ )                                      | .. | .. | "                      | "              |
| 5.         | <i>Cardium inæqualis</i> , A. Bell, ( $\times 4$ )                         | .. | .. | "                      | "              |
| 6.         | <i>C. strigilliferum</i> , S. W., ( $\times 4$ )                           | .. | .. | "                      | "              |
| 7.         | <i>Astarte pygmæa</i> , Miinst., ( $\times 4$ )                            | .. | .. | "                      | "              |
| 8.         | <i>Lutraria rugosa</i> , Chem.                                             | .. | .. | "                      | "              |
| 9.         | <i>Gastrana fragilis</i> , L.                                              | .. | .. | "                      | "              |
| 10.        | <i>Donax vittatus</i> , Da C., var. <i>nitidus</i> , Jeff., ( $\times 2$ ) | .. | .. | "                      | "              |
| 11.        | <i>Dentalium candidum</i> , Jeff., ( $\times 3$ )                          | .. | .. | "                      | "              |
| 12.        | <i>D. panormum</i> , ? Chem., ( $\times 3$ )                               | .. | .. | "                      | "              |
| 13, 13a.   | <i>Chiton siculus</i> , Gray, ( $\times 3$ )                               | .. | .. | "                      | "              |
| 14, 14a.   | <i>Otina otis</i> , Turton, ( $\times 6$ )                                 | .. | .. | "                      | "              |
| 15         | <i>Trochus exasperatus</i> , Pult., ( $\times 2$ )                         | .. | .. | "                      | "              |
| 16, 16a.   | <i>Cyclostrema elegantula</i> , Phil., ( $\times 6$ )                      | .. | .. | "                      | "              |
| 17.        | <i>Barleeia cingulata</i> , A. Bell, ( $\times 4$ )                        | .. | .. | "                      | "              |
| 18.        | <i>Hydrobia compactilis</i> , A. Bell, ( $\times 4$ )                      | .. | .. | "                      | "              |
| 19.        | <i>Rissoa striatula</i> , Mont., ( $\times 4$ )                            | .. | .. | "                      | "              |
| 20.        | <i>R. Montagui</i> , Payr., ( $\times 4$ )                                 | .. | .. | "                      | "              |
| 21.        | <i>R. cimex</i> , L., ( $\times 4$ )                                       | .. | .. | "                      | "              |
| 22.        | <i>R. scutula</i> , A. Bell, ( $\times 4$ )                                | .. | .. | "                      | "              |
| 23.        | <i>R. bicarinata</i> , A. Bell, ( $\times 4$ )                             | .. | .. | "                      | "              |
| 24.        | <i>R. lactea</i> , Mich., ( $\times 4$ )                                   | .. | .. | "                      | "              |
| 25.        | <i>R. deliciosa</i> , Jeff., ( $\times 4$ )                                | .. | .. | "                      | "              |
| 26.        | <i>R. multistriata</i> , A. Bell, ( $\times 4$ )                           | .. | .. | "                      | "              |
| 27a, b, c. | <i>Solariella acutangula</i> , A. Bell, ( $\times 4$ )                     | .. | .. | "                      | "              |
| 28a, b, c. | <i>S. approximata</i> , A. Bell, ( $\times 4$ )                            | .. | .. | "                      | "              |
| 29.        | <i>Scalaria foliacea</i> , J. Sow., ( $\times 4$ )                         | .. | .. | "                      | "              |
| 30.        | <i>Aclis unica</i> , Mont., ( $\times 4$ )                                 | .. | .. | "                      | "              |
| 31.        | <i>Sphenotrochus selseyensis</i> , A. Bell, ( $\times 4$ )                 | .. | .. | "                      | "              |
| 32.        | <i>Micropora regularis</i> , d'Orb.                                        | .. | .. | "                      | "              |
| 32a.       | The same specimen magnified.                                               |    |    |                        |                |
| 33.        | <i>Diastopora regularis</i> , d'Orb., var. <i>selseyensis</i> , A. Bell    | .. | .. | "                      | "              |
| 33a.       | The same specimen magnified.                                               |    |    |                        |                |

Pres.  
7 JUL. 93



